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PHYSICS ABSTRACTS

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Physics Abstracts

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Electronic relays and counters	Photocells	Electroacoustic apparatus
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PHYSICS ABSTRACTS

Volume 59 DECEMBER 1956 Number 708

MATHEMATICS 51

518.5 : 621.372

8546. COMPLEX LOGARITHMIC CYLINDER [FOR A.C. NETWORKS]. E.Kuczogi and E.Tőth.
Elektrotechnika, Vol. 49, No. 5, 139-143 (May, 1956). In Hungarian.

A calculating instrument is described which is capable of performing calculations with complex (vector) quantities similar to those which the logarithmic slide rule does with real (scalar) quantities. The Cartesian and polar coordinates of the Gaussian plane are substituted by a family of curves in logarithmic relation, and the multiplication and division of complex numbers is reduced to adding or subtracting vectors. Examples are shown how the instrument can be used for solving a.c. network problems. L.Csuros

518.5

8547. PHASE CALCULATIONS FOR NUCLEAR SCATTERING ON THE PILOT ACE. H.H.Robertson.
Proc. Cambridge Phil. Soc., Vol. 52, Pt 3, 538-45 (1956).

The Pilot ACE has been used to solve integro-differential equations appearing in the theory of nuclear scattering. The application of finite-difference approximations results in a set of simultaneous algebraic equations which are solved to obtain the wave function and from this the phase is evaluated. A.

519.2 : 537.591.15

8548. A MEASURE OF DISPERSION APPLIED TO COSMIC RAY AND OTHER PROBLEMS. S.R.Broadbent.
Proc. Cambridge Phil. Soc., Vol. 52, Pt 3, 499-513 (1956).

The statistic $\Delta^2 = \sum_{i,j=1}^{n} \{(x_i - x_j)^2 + (y_i - y_j)^2\}/n(n-1)$ is applied in several different situations to detect departure from uniform dispersion. The given sample points may lie on a square lattice (without repetition), a rectangular lattice (repetition being allowed), or within rectangular or circular plane boundaries. The problems considered include an analysis of cosmic-ray shower structure, and the counting of dust particles and bacterial colonies. A.

ASTRONOMY . ASTROPHYSICS . GEODESY 52

522.61 : 523.164

8549. THE MULTIPLE-AERIAL INTERFEROMETER OF THE STATION AT NANÇAY. E.J.Blum, A.Boischot and M.Ginat.
C.R. Acad. Sci. (Paris), Vol. 243, No. 1, 19-22 (July 2, 1956). In French.

A description is given of an interferometer consisting of eight parabolae of 5 m diameter, equally spaced along a 700 m East—West line, and working on 1.77 m wavelength. The sensitivity lobes are separated by $\sim 1^0$, with half-power widths of 7'5 in the E—W direction, and $\sim 30^0$ in the meridian. The system permits the localization of active centres on the sun. M.W.Ovenden

523.11

8550. REMARKS ON NEWTONIAN COSMOLOGY. II. O.Heckmann and E.Schücking.
Z. Astrophys., Vol. 40, No. 2, 81-92 (1956). In German.

For Pt I, see Abstr. 870 (1956). The theory of potential of infinite distributions of matter is discussed in connection with Newtonian cosmology. New boundary conditions are given for the potential, independently of the postulate of homogeneity. The thermodynamics of cosmological models is studied, and the theory of potential distribution, as developed in the earlier part of the paper, is applied to the two body problem of Newtonian mechanics. L.S.Goddard

523.11 : 530.12

INERTIAL PATHS IN GÖDEL'S COSMOLOGICAL MODEL. See Abstr. 7949

523.161

8551. MATTER AND ANTI-MATTER. G.R.Burbidge and F.Hoyle.
Nuovo Cimento (Ser. 10), Vol. 4, No. 3, 558-64 (Sept., 1956).

The implications of anti-matter (consisting of positrons and antiprotons) existing on a cosmic scale are discussed. It is shown from a consideration of the kinetic and magnetic energy of the interstellar gas clouds and from the energy of cosmic radiation that the ratio of anti-matter to ordinary matter in our Galaxy cannot exceed $\sim 10^{-7}$. The importance to radio astronomy of such a limit being attained is investigated. It appears that the intensities of radio emission from galactic and extra-galactic sources may be quantitatively explained on this hypothesis. The relation of these ideas to cosmology is also briefly discussed. A.

523.164

8552. RADIO ASTRONOMY. J.L.Pawsey and R.N.Bracewell.
London: Oxford University Press (1956) x + 361 pp. (International Monographs on Radio).

Review in J. atmos. terrest. Phys., Vol. 8, No. 6, 352 (June, 1956).

523.164 : 551.510.535

THE SPECTRUM OF RADIO-STAR SCINTILLATIONS AND THE NATURE OF IRREGULARITIES IN THE IONOSPHERE. See Abstr. 8505

523.164.4

8553. GALACTIC RADIO EMISSION AND THE ENERGY RELEASED IN NUCLEAR COLLISIONS OF PRIMARY COSMIC-RAY PROTONS. G.R.Burbidge.

Phys. Rev., Vol. 103, No. 1, 264 (July 1, 1956).

The galactic radio emission is supposed to be produced by the synchrotron mechanism, the electrons and positrons of the requisite energies being produced following nuclear collisions between cosmic-ray protons and interstellar hydrogen atoms. The feasibility of this latter hypothesis is demonstrated by a semiquantitative discussion of the equilibrium between electron–positron energy production and synchrotron radiation. It is therefore suggested that the radio emission of normal galaxies is a natural result of the presence of a cosmic-ray flux in the presence of interstellar gas and magnetic field. M.W.Ovenden

523.164.43

8554. AN INVESTIGATION OF MONOCHROMATIC RADIO EMISSION OF DEUTERIUM FROM THE GALAXY. G.J.Stanley and R.Price.
Nature (London), Vol. 177, 1221-2 (June 30, 1956).

The experimental technique, in which the aerial was a paraboloid of 80 ft diameter, and the radiometer of the type used by van de Hulst, Muller and Oort (Bulletin of the Astronomical Institutes of the Netherlands, Vol. 12, 452, 1954), is described in detail. Observations were confined to the region of the galactic centre and the region in the galactic plane of longitude 220^0. The failure to detect the deuterium line leads to an upper limit to the density of deuterium in the galaxy of 10^{-3} that of hydrogen M.W.Ovenden

523.45/.481

8555. INTERIOR STRUCTURE AND CHEMICAL COMPOSITION OF THE GIANT PLANETS. S.V.Kozlovskaya.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 3, 409-12 (1956). In Russian.

Develops the applications of the theories of Ramsey, Abrikosov and Davȳdov that the planet comprises an inner metallic core and an outer gaseous phase. Considers Saturn, Jupiter, Neptune and Uranus. J.M.Hough

523.53 : 551.593

NOTE ON PERSISTENT METEOR TRAILS. See Abstr. 9120

523.59

8556. THE ABSOLUTE PHOTOMETRY OF THE GEGENSCHEIN. F.E.Roach and M.H.Rees.
Airglow and the aurorae (Belfast) 142-55. See Abstr. 7988 (1956).

A photoelectric photometer of the type used in airglow observations has been applied to the study of the gegenschein and zodiacal light. The part of the zodiacal cloud studied is that outside the earth's orbit. The conclusions reached on the basis of the observations are that the gegenschein and the adjacent zodiacal light are due to separate and distinct concentrations of particles, and that the part of the zodiacal cloud investigated is at a distance of about one astronomical unit from the earth, or between the orbits of Jupiter and Mars. The observed spotty nature of the zodiacal cloud indicates local concentrations of particles. A.

523.72 : 537.591.5

8557. THE SOLAR OUTBURST, 23 FEBRUARY 1956. OBSERVATIONS BY THE ROYAL GREENWICH OBSERVATORY. T.Gold and D.R.Palmer.
J. atmos. terrest. Phys., Vol. 8, No. 4-5, 287-91 (May, 1956).

Cosmic-ray observations, solar photographic observations, magnetic records, and low-frequency radio observations were carried out by the Royal Greenwich Observatory on a routine basis during the period of interest for the investigation of the solar flare that occurred at 0330 on 23 February, 1956. The data obtained and relevant instrumental details are presented. A.

523.72 : 538.569

ELECTROMAGNETIC RADIATION FROM ELECTRON PLASMA. See Abstr. 8886

523.72 : 537.591.5

THE SOLAR OUTBURST OF 23 FEBRUARY, 1956: COSMIC-RAY OBSERVATIONS. See Abstr. 8271-2, 8857

523.75

8558. THE DEVELOPMENT OF LONG-LIVED FILAMENTS, AND THEIR ORIENTATION ON THE SOLAR DISK. U.Becker.
Z. Astrophys., Vol. 40, No. 1, 65-77 (1956). In German.

Characteristic changes in the linear dimensions of long-lived solar filaments are discussed; and it is shown that: (i) the observed poleward motion of the centre of gravity is due to an increase in the length of the filament, (ii) the change in orientation with heliographic latitude results from a shearing action on the developing filament due to differential rotation, and (ii) the predominantly westward inclination of the vertical plane through the filament is the combined result of a repulsive action of the magnetic field associated with the active spot region, and of the fact that statistically three times as many filaments lie to the west of the associated spot as lie to the east of it (d'Azambuja, 1948). D.R.Barber

523.752

8559. HETEROGENEITY OF SOLAR CHROMOSPHERE AND THE PROBLEM OF HELIUM EXCITATION. V.Krat.
Dokl. Akad. Nauk SSSR, Vol. 106, No. 4, 619-22 (1956). In Russian.

In a previous paper (Krat and Krat, Izvestiya Glavnoĭ Astronomicheskoi Observatorii, No. 153, 1955) it was shown that the excitation of H in the chromosphere was not anomalous and that the luminescence of the Balmer-series lines was caused by the scattering of light emitted by a rotating layer; the chromosphere was assumed to be an aggregate of moving filament-shaped elements with a relatively low (gas-kinetic) mean temperature $T \sim 8000^0$ K. The analysis of the observed contours of different lines of H, Ti and Mg yields different values of ξ (mean "Doppler" velocity) for H and the metals. The ξ values are, however, almost identical for H_ε and the 3889 A He line; this implies $T_{He} \sim 4\, T_H$, i.e., the He filaments are incomparably hotter than the H filaments. This high temperature ($3 \times 10^4 - 10^5$ degrees) can be explained by assuming the ionization of He in the chromosphere as being caused by electron impact. F.Lachman

523.841.11

8560. CALIFORNIUM-254 AND SUPERNOVAE. G.R.Burbidge, F.Hoyle, E.M.Burbidge, R.F.Christy and W.A.Fowler.
Phys. Rev., Vol. 103, No. 5, 1145-9 (Sept. 1, 1956).

It is suggested that the spontaneous fission of Cf^{254} with a half-life of 55 days is responsible for the form of the decay light-curves of supernovae of Type I which have an exponential form with a half-life of 55 nights. The way in which Cf^{254} may by synthesized in a supernova outburst, and reasons why the energy released by its decay may dominate all others are discussed. The presence of Tc in red giant stars and of Cf in Type I supernovae appears to be observational evidence that neutron capture processes on both a slow and a fast time-scale have been necessary to synthesize the heavy elements in their observed cosmic abundances. A.

523.877

8561. ON THE SPHERICALLY SYMMETRIC NON-ADIABATIC MOTION OF A GAS SPHERE. G.C.McVittie and M.H.Rogers.
Astron. J., Vol. 60, No. 10, 374-9 (Nov., 1955).

Exact solutions of the equations of classical gas dynamics are used to describe an idealized model of a supernova explosion. The total loss of energy is evaluated in terms of the initial central temperature and the mass concentration of the

star, and it is found that for each value of the mass concentration there is a unique central temperature below which no energy can be emitted. A central temperature of twenty million degrees is then assumed and the amounts of energy emitted for varying values of the mass concentration are calculated; these are found to be of the order of 10^{50} ergs. A.

523.877

8562. THE PERIOD—LUMINOSITY RELATION IN POPULATION II. V.C.Reddish.
Monthly Not. Roy. Astron. Soc., Vol. 115, No. 5, 480-6 (1955).

Correlations between the periods, luminosities and radii of Population II variables with periods between one and a hundred days are investigated. It is shown that the recently suggested division of the period—luminosity relation into three discrete lines probably cannot be justified on the basis of existing data. A further analysis of the published observations on twelve variables leads to the conclusion that two of the variables differ considerably in composition, though not in mass, from the remainder, and have therefore probably evolved along different lines. A.

523.877

8563. INFLUENCE ON THE SPECTRAL CHARACTERISTICS, OF THE MANNER OF HEAT TRANSFER IN THE CONVECTIVE ZONE OF A STELLAR ATMOSPHERE. M.Hack.
Ricerca sci., Vol. 26, No. 6, 1826-47 (June, 1956). In Italian.

16 models of stellar atmospheres are calculated for θ_0: 0, 6 0,7; 0.8; 0.9; 1.0 and log g: 1.5; 2.5; 3.5; 4.5. Two extreme hypotheses are offered for the convective zone: (a) the transfer occurs by radiation only (b) the transfer occurs by convection only. Two pairs of models are calculated in relation to these hypotheses. The spectral gradients between 4250 and 6250 A, φ, and the Balmer's discontinuities , D, are calculated for the 16 pairs of models and the results are compared with the observations, to decide, if possible, what is the prevailing manner of transfer in the convective zone of stellar atmospheres. The observed curves $D = f(\varphi)$ coincide with the curves calculated with radiative models, in the case of dwarf and giant stars; in the case of supergiant stars, on the other hand, the agreement with observations is found only taking mean values between the values of D and φ calculated with radiative and adiabatic models. A.

525.6

8564. "POLAR TIDES" IN THE EARTH'S OCEANS. I.V.Maksimov.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 5, 799-801 (1956). In Russian.

Calculations have been made for Schweydar's "polar tides" (Veröffentlichungen des Kgl. Preussischen Geodätischen Instituts in Potsdam, N.F., No. 66, 1916) for three 7-year periods for 74 ports both for amplitude and phase. J.M.Hough

526.92

8565. AN OPTICAL RANGEFINDER FOR GEODESIC SURVEYS. A.A.Lebedev, V.V.Balakov and V.G.Vafiadi.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 3, 458-60 (1956). In Russian.

Uses a modulated light source to transmit light to a reflector from which it is received by a modulated detector; variation of the phase difference between the detector and receiver enables the distance to be measured. The modulation at a frequency of the order of 1-5 Mc/s is achieved by using a Michelson interferometer with the surface of a piezoelectric quartz crystal as one of the mirrors. An accuracy of 1 in 200 000 is claimed for a range of 17 km. J.M.Hough

PHYSICS 53

FUNDAMENTALS 530.1

530.12

8566. CONTRIBUTIONS TO THE UNIFIED THEORY OF PHYSICAL FIELDS. J.I.Horváth.
Nuovo Cimento (Ser. 10), Vol. 4, No. 3, 577-81 (Sept., 1956).

Discussing Einstein's criteria of unified theory of physical fields it is suggested that the second criterion: "Neither the field equations nor the Hamiltonian function can be expressed as a sum of several invariant parts, but are formally unified entities" should be replaced by a weaker one: "Neither the field equations nor the Hamiltonian function can be expressed as the sum of several invariant parts which have an individual geometrical meaning" and Einstein's criteria should be completed by the following: "From the field equations of a (nonlinear) unified field theory the correct equations of motion must be deduced". A.

530.12 : 531.18

8567. NONCLASSICAL TRANSFORMATION IN SPECIAL RELATIVITY. F.B.Estabrook.
Phys. Rev., Vol. 103, No. 5, 1379-80 (Sept. 1, 1956).

The "nonclassical" complex Lorentz transformation, recently introduced as a mathematical convenience by Reulos, is related to the unique factoring of any 4 x 4 orthogonal transformation. This factoring also shows, in 4 x 4 form, the well-known possibility of introducing a 2 x 2 complex spin space, in which unimodular transformations are isomorphic to the proper future-preserving Lorentz group. A.

530.12 : 532.51

8568. VARIATION PRINCIPLE IN RELATIVISTIC HYDRODYNAMICS. Z.Koba.
Progr. theor. Phys., Vol. 14, No. 5, 488-90 (Nov., 1955).

Following Khalatnikov's use of a variational principle based on the analogy to relativistic particle dynamics (Abstr. 5856/1955), it is shown that, in the two limiting cases of very-high and very-low temperature, the behaviour of an ideal compressible fluid can be described by a variation method which closely resembles that of field dynamics. W.A.Hepner

530.12

8569. ON THE WAVE THEORY OF LIGHT IN GENERAL RELATIVITY. III. ELECTROMAGNETIC FOUR POTENTIAL. H.Takeno and Y.Ueno.
Progr. theor. Phys, Vol. 15, No. 4, 322-32 (April, 1956).

For Pt II, see Abstr. 3410 (1955). The character of the generalized field equation for the electromagnetic four potential in curved space-time is investigated. The main problems treated in this paper are (i) the problems concerning the gauge transformation and the auxiliary condition, and (ii) those concerning the properties of the spherical wave solutions of the field equation in static spherically symmetric space-time. A.

530.145 : 530.12

8570. A RELATIVISTIC FIELD THEORY OF AN EXTENDED PARTICLES. I. T.Nakano.
Progr. theor. Phys., Vol. 15, No. 4, 333-68 (April, 1956).

Quantization of motion of a rigid body and its extension to the relativistic form are attempted. The special theory of relativity is believed to rule the phenomena in the macroscopic world. But the laws governing the microscopic world, as in the interior of an elementary particle, are not yet known. Here it

is assumed that the internal space of an elementary particle is Euclidean. The field equation, however, has the relativistically invariant form so that the expectation values of observable quantities become relativistically covariant. The condition that the time components of an internal angular momentum have zero expectation values in the rest system leads to the general linear equation derived by Bhabha for elementary particles with arbitrary spins. For the case when interactions are absent, the solutions of the field equations are obtained and the field of a rigid sphere is quantized. A.

530.145

8571. SECOND QUANTIZATION IN PHASE SPACE. Yu.L.Klimontovich.
Dokl. Akad. Nauk SSSR, Vol. 96, No. 1, 43-6 (1954). In Russian.

A system of particles is considered with two-body interaction depending on distance only and formulae are obtained connecting the energy and momentum in excited states for bosons and fermions. One of the formulae generalizes a result of Tomonaga (Abstr. 3324/1951). Mathematical Reviews

530.145

8572. ON THE QUANTUM THEORY OF A FIELD WITH CAUSAL OPERATORS. Yu.V.Novozhilov.
Dokl. Akad. Nauk SSSR, Vol. 99, No. 5, 723-6 (1954). In Russian.

Continuing his earlier paper (1954) the author now deduces the commutation laws for causal operators at any two space–time points. He shows that the equation of motion in the interaction representation is integrable, and leads to the correct perturbation theory expansion of the S-matrix. It appears that the author's formalism is identical with that of F.Coester (Abstr. 2204/1953), although it was developed independently. Mathematical Reviews

530.145

8573. ON THE USE OF FEYNMAN AMPLITUDES IN THE QUANTUM FIELD THEORY. Z.Maki.
Progr. theor. Phys, Vol. 15, No. 3, 237-54 (March, 1956).

A set of Feynman amplitudes (connected Feynman amplitudes) with no irrelevant dependences due to vacuum effects is introduced systematically in conjunction with the definition of connected parts of Green's functions. Coupled differential equations of these amplitudes are derived, and as an illustration of the method, equations for the anharmonic oscillator are studied. Detailed investigations on the asymptotic behaviour of Feynman amplitudes show that only the connected F.A. provides S-matrices for arbitrarily complicated processes in an unambiguous way. A.

530.145

8574. THEORY OF MASS REVERSAL IN THE QUANTIZED FIELD THEORY. T.Ouchi, K.Senba and M.Yonezawa.
Progr. theor. Phys, Vol. 15, No. 5, 431-44 (May, 1956).

Detailed discussions of mass reversal in the quantized field theory are given. The construction of the mass reversal operator M is possible and the explicit form is given. It is shown that the mass reversal operation does not imply the hypothetical reversal of the sign of the intrinsic mass of the elementary particle, but the change of the direction of the intrinsic spin relative to the momentum for the spinor field. One result of this operation on the interaction Hamiltonian is to forbid the mixing of the couplings with and without derivatives for the pion–nucleon interaction. It seems natural to take the mass reversal as a new fundamental invariance (symmetry) principle other than those hitherto investigated. A.

530.145

8575. ATOMIC THEORY OF ELECTROMAGNETIC INTERACTIONS IN DENSE MATERIALS. U.Fano.
Phys. Rev., Vol. 103, No. 5, 1202-18 (Sept. 1, 1956).

This theory develops a quantum analogue of the classical electron oscillator model. It argues first that the Hamiltonian of long-wave excitations of matter is equivalent to that of an assembly of oscillators under very general assumptions. Next, these oscillators are coupled with the electromagnetic field oscillators and the normal modes of the coupled system are analysed. The normal modes of longitudinal and transverse excitation have different spectra; the transverse frequencies depend strongly on the wavelength but the longitudinal ones do not. If the "longitudinal photons" are eliminated after the transformation to normal modes, the resulting Coulomb law has the dielectric constant in the denominator. The dielectric response law is expressed as a series of oscillations and also in terms of Van Hove's correlation function. Born approximation theory of the collisions of fast charged particles with the assembly of normal mode (longitudinal and transverse) oscillators yields the same total cross-section as Fermi's macroscopic theory. The transverse excitations include the Cherenkov radiation. A.

530.145

8576. ON THE ONE PION EXCHANGE POTENTIAL. K.Hiida, J.Iwadare and S.Machida.
Progr. theor. Phys, Vol. 15, No. 3, 189-92 (March, 1956).

It is shown by a general argument that the one-pion exchange potential is not changed but the unrenormalized coupling constant must be replaced by the renormalized one, in the region far from the origin, where the static approximation is allowed, by the inclusion of the radiative effects. It is found in the analysis of two-nucleon problems that the one-pion exchange given in the meson theory of nuclear forces plays the main role in the low-energy region and gives excellent agreement with experiment. A.

530.145

8577. VARIOUS TYPES OF CHARGED PARTICLE WITH SPIN ONE. J.Géhéniau.
Bull. Acad. Roy. Belgique Cl. Sci., Vol. 41, No. 9, 875-82 (1955). In French.

Particles of spin one other than that of Proca are defined theoretically. They have intrinsic electric and magnetic moments of equal magnitude. The corresponding field may be described by two vectors, by an antisymmetric tensor, or by two self-adjoint antisymmetric tensors. The connection between theories of this kind due to H.Donnert and J.M.Whittaker is established. J.S.Bell

530.145

8578. ON THE CORRESPONDENCES BETWEEN BIVECTORS AND SIMPLE SPINORS, AND THE CORPUSCULAR DESCRIPTION OF ELECTROMAGNETIC WAVES. G.Bodiou.
J. Phys. Radium, Vol. 17, No. 4, 350-8 (April, 1956). In French.

A two–one correspondence between 2-spinors and real skew symmetric tensors is used to represent a plane wave in terms of two Dirac particles of zero mass and zero spin density. A detailed examination is made of the relation of the present theory to de Broglie's theory of the photon. R.A.Newing

530.145

8579. ON THE CLASSICAL LIMIT OF DIRAC'S THEORY OF A SINGLE PARTICLE. P.Bocchieri and A.Loinger.
Nuovo Cimento (Ser. 10), Vol. 3, No. 6, 1474-5 (June, 1956). In Italian.

It is concluded, in agreement with Pauli, that in the classical limit the particle has no spin. This contradicts the conclusion of Takabayasi (Abstr. 4192-3/1956) that the particle is endowed with a spin in this limit. J.M.Radcliffe

530.145

8580. AN ELEMENTARY PROOF OF THE CAUSAL INEQUALITIES OF WIGNER. A.Martin.

C.R. Acad. Sci. (Paris), Vol. 243, No. 1, 22-3 (July 2, 1956). In French.

Some inequalities due to Wigner (Abstr. 4376/1955) are deduced directly from the Schrödinger equation.

P.T.Landsberg

530.145

8581. THE RELATIVISTIC EQUATION OF THREE COUPLED BODIES. D.Ivanenko and V.Tsȳtovich.
Dokl. Akad. Nauk SSSR, Vol. 99, No. 3, 373-6 (1954). In Russian.

An exact form is written down for the relativistic wave equation of a system of three Fermi particles coupled by a boson field. The specific three-particle interaction appears as an expression involving functional derivatives of two-particle interactions, and could in principle be evaluated as a power series in the coupling constant.

Mathematical Reviews

530.145

8582. EXCHANGE AND CAPTURE IN THE PROBLEM OF THREE BODIES. V.M.Alekseev.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 4, 599-602 (1956). In Russian.

Three bodies interacting with a Newtonian potential may initially have infinite distances and one of them may join up with a pair at permanently finite distance ("capture"). Alternatively a body, initially at infinite distance from a pair may approach and stay permanently at a finite distance from one of the other bodies whereas the third removes to infinity ("exchange"). By way of a series of theorems, deduced from the equations of motion, conditions are derived which are sufficient for capture or exchange taking place. It is shown that the image points in three-body phase space corresponding to initial conditions for capture or exchange fill a finite phase volume.

R.Eisenschitz

530.145

8583. SCATTERING OF ZERO SPIN PARTICLES INCLUDING DAMPING. A.A.Sokolov and B.K.Kerimov.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 4, 611-14 (1956). In Russian.

The case in which the scattering centre is spherically symmetrical and has a small range is treated.

G.E.Brown

530.145

8584. HIGHER APPROXIMATIONS IN THE METHOD OF THE SELF-CONSISTENT FIELD OF MESON THEORY. E.L.Feĭnberg and D.S.Chernavskiĭ.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 4, 619-22 (1956). In Russian.

In the author's earlier work (1955) the one-meson approximation was employed. If the interaction Hamiltonian does not contain the operators σ and τ, this gives an incorrect result. With the presence of noncommuting operators, the higher approximations are not important, however.

G.E.Brown

530.145

8585. THEORY OF MULTIPLE BOSON PRODUCTION. Y.Takahashi.
Nuovo Cimento (Ser. 10), Vol. 4, No. 3, 531-48 (Sept., 1956).

A general formula for the multiple boson production is derived. The introduction of a statistical idea to the general formula is made. Neither comparison to experimental data nor interpretation of them is given, but the discussion is restricted to the treatment of the several theories proposed so far from a unifying viewpoint, particularly the field theoretical foundation of Fermi's statistical theory is discussed in detail.

A.

530.145

8586. ON A NEW APPROXIMATE ONE-VELOCITY THEORY OF MULTIPLE SCATTERING IN INFINITE HOMOGENEOUS MEDIA. C.C.Grosjean.
Nuovo Cimento (Ser. 10), Vol. 4, No. 3, 582-94 (Sept., 1956).

Within the framework of a new approximate formalism for solving one-velocity multiple scattering problems in infinite homogeneous media, which was presented in an earlier paper, the appropriate expressions for the particle current are derived and carefully discussed in both cases of isotropic and slightly non-isotropic scattering. A detailed comparison between the corresponding rigorous and approximate formulae is carried out in the special case of an isotropic point source and leads to the conclusion that the newly derived approximations are highly accurate and possess remarkable properties.

A.

530.145

8587. NUCLEAR SATURATION AND TWO-BODY FORCES: SELF-CONSISTENT SOLUTIONS AND THE EFFECTS OF THE EXCLUSION PRINCIPLE. K.A.Brueckner and W.Wada.
Phys. Rev., Vol. 103, No. 4, 1008-16 (Aug. 15, 1956).

The equilibrium properties of uniform nuclear matter have been studied in previous papers by using a self-consistency method to determine two-body reaction matrices and the average effective one-particle potential which they generate. In this paper the self-consistency method is simply illustrated by using some explicit examples. An investigation is also made of the previously neglected effects of the exclusion principle on transitions to intermediate states. A variational expression is used for the reaction matrix, utilizing as a trial function the wave-function which is exact if the exclusion effect is neglected. Two-body potentials are used which simulate the actual forces, i.e., square wells with a repulsive core of 0.35 $\hbar/\mu c$, range of 1.15 $\hbar/\mu c$, and depth 98.3 MeV, acting on s-states only. It is found that for effective mass values of 0.5 M and 0.6 M, the reaction matrix is appreciably altered, particularly for low values of relative momentum. The requirements of self-consistency, however, almost entirely compensate for the change in the reaction matrices so that at normal density in the effective mass approximation the final result for the average binding energy is precisely the same as that obtained when exclusion effects are neglected. The reasons for this simple result are discussed. Further approximations are discussed which are suitable for more exact computations and which allow inclusion of the exclusion effects, the departures from the effective mass approximation, and the effects of "propagation off the energy shell". Approximation methods for a finite nucleus are discussed and a simplified Hartree–Fock method using "pseudo-potentials" (in the sense of Fermi) is described.

A.

530.145

8588. TRANSITION FROM DISCRETE TO CONTINUOUS SPECTRA. B.S.DeWitt.
Phys. Rev., Vol. 103, No. 5, 1565-70 (Sept. 1, 1956).

The stationary states of a system bound in a spherical box and additionally subjected to a perturbation of finite range are studied in the limit as the box radius becomes infinite. The transition from formal discrete spectrum theory to formal scattering is carried out explicitly by two different methods. It is shown quite generally (i.e., even when the total Hamiltonian is not separable) that the level shift produced by the perturbation is proportional to the corresponding scattering phase shift.

A.

530.145

8589. SITUATION OF RARITA–SCHWINGER PARTICLE AS A MODEL OF NUCLEON ISOBAR. D.Ito and S.Minami.
Progr. theor. Phys., Vol. 14, No. 5, 487-8 (Nov., 1955).

Only in the energy region where effects are dominated by the nucleon isobar does the Rarita–Schwinger particle model give results similar to those obtained by the Tamm–Dancoff method.

P.T.Matthews

530.145

8590. PION THEORY OF NUCLEAR FORCES. K.Inoue, S.Machida, M.Taketani and T.Toyoda.
Progr. theor. Phys., Vol. 15, No. 2, 122-36 (Feb., 1956).

Recently a general and formal method for constructing nuclear potentials has been proposed by Fukuda, Sawada and Taketani. Applying the method to the pion theory and adopting fixed and extended sources, the authors have evaluated nuclear potentials. The result seems to be in favour of that of Taketani, Machida and Onuma rather than that of Brueckner and Watson. As a cut-off function a Gaussian error function with $k_{max} = 6\mu c$ was assumed. In the case of the effective coupling constant $g^2/4\pi = 0.08$ it is found that the effect of the extended source becomes very strong in the region for $r < 0.7\,\hbar/\mu c$. If these potentials are used for $r > \hbar/\mu c$ and phenomenological potentials inside this range, satisfactory results may be obtained to explain the properties of the two-nucleon system in the low-energy region. A.

530.145

8591. INTERMEDIATE COUPLING MESON THEORY OF NUCLEAR FORCES. II. Y.Nogami and H.Hasegawa.
Progr. theor. Phys., Vol. 15, No. 2, 137-150 (Feb., 1956).

In Pt I (Abstr. 9427/1955) a method was proposed for constructing the nuclear potential by means of intermediate coupling theory, where the charged scalar theory was taken as an example. In this paper, the method is applied to the realistic case, symmetrical pseudo-scalar theory with pseudo-vector coupling, and the static nuclear potential is obtained up to the order of $e^{-2\chi}$, where $\chi = \mu r$. The results are found on the cut-off procedure which is inevitably introduced to avoid divergence troubles. A cut-off factor should be chosen so that effects of the so-called contact interaction do not extend on to the exterior region $\chi > \sim 1.0$. A cut-off factor of Gaussian type is taken as a suitable one. The potential does not essentially differ from the FST-potential and the BW potential with cut-off. After the renormalization of the coupling constant, the potential of the order of $e^{-\chi}$ coincides with the conventional second-order perturbation potential in the exterior region, irrespective of an assumed "structure" of the clothed nucleon. The potential of the order of $e^{-2\chi}$, however, depends essentially on the cut-off factor. A.

530.145 : 539.18

8592. REMARKS ON THE PION-PION INTERACTION. Z.Koba.
Progr. theor. Phys, Vol. 15, No. 5, 461-72 (May, 1956).

The Cosmotron data on pion–nucleon reactions suggest the presence of a fairly strong pion–pion interaction near 1 GeV. The cosmic-ray experiment performed recently by the Bristol group, when analysed according to the Landau theory of multiple production, leads to a similar conclusion. A.

530.145

8593. STRONG COUPLING NUCLEOMESODYNAMICS. III. TRANSLATIONAL MOTION, MESON-FIELD MASS AND NUCLEAR MAGNETIC MOMENT. I.M.Dykman and S.I.Pekar.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1125-41 (1956). In Russian.

For Pt II see Abstr. 4836 (1956). An extended nucleon strongly interacting with the meson field is considered. The meson field is assumed to be pseudoscalar and the interaction of the pseudovector type. A method is developed which is based on the expansion of the solution into powers of the inverse nucleon mass. In the zero approximation the result corresponds to an infinitely heavy nucleon and is the same as the result deduced earlier. The method is applicable only for sufficiently slow (nonrelativistic) nucleons. The wave function of the system has been calculated with an accuracy to terms of first power of the inverse nucleon mass; the meson-field nuclear mass has been computed to terms quadratic with respect to the inverse nuclear mass. The nucleon magnetic moment has been computed on the assumption of a very strong coupling between the meson field and nucleon and has been expressed by an expansion in powers of the inverse nucleon mass. The first term of the series corresponds to the infinitely heavy nucleon approximation and the remaining terms yield a correction connected with the translational motion of the nucleon. The results indicate that the difference between the proton and neutron magnetic moments should not be explained by invoking nucleon translational motion but by rejecting the assumption of extremely strong coupling. A.

530.145 : 539.172

8594. SCATTERING MAXIMA AND BOUND STATES. H.Rollnik.
Z. Phys., Vol. 145, No. 5, 639-53 (1956). In German.

The problem of non-relativistic motion in a central field is studied with a view to relating the maxima of cross-sections to the bound states. This is compared with the work of Jost and Pais (Abstr. 6747/1951) and with Wigner's dispersion theory (Abstr. 7537/1952). W.A.Hepner

530.145

8595. ON THE THEORY OF DECAYING STATES. H.Rollnik.
Z. Phys., Vol. 145, No. 5, 654-61 (1956). In German.

It is shown that, if the potential vanishes outside a finite radius, the S-matrix has a finite number of poles on the imaginary k-axis (bound states) but has an infinite number of complex poles (decaying states) of which only a finite number can be physically noticeable. This is compared with the results of the preceding paper. W.A.Hepner

530.145

8596. THE COMPLEX SOLUTIONS OF THE SCHRÖDINGER EQUATION AND THE W.K.B. METHOD. I.Lentei.
Acta phys. Hungar., Vol. 5, No. 3, 353-6 (1955). In German.

The W.K.B. method is studied with reference to the simple problems:(a) linear oscillator, (b) ground state of the hydrogen atom. Some remarks are made, in the light of this discussion, concerning the validity of the method. P.T.Landsberg

530.145

8597. A QUANTUM MECHANICAL DESCRIPTION OF COLLECTIVE MOTIONS. R.Skinner.
Canad. J. Phys., Vol. 34, No. 9, 901-13 (Sept., 1956).

A rigorous and general formalism is presented for the quantum mechanical description of the collective motions of a system containing a finite number of particles. The dynamical equations are expressed in terms of collective and "internal" coordinates. The internal coordinates are symmetrical in the particles, and correspond to the laboratory coordinates with the collective motions subtracted off. The formalism is applied to centre of mass motion. A.

530.145 : 530.162

8598. DETERMINATION OF SPECIFIC VALUES OF PHYSICAL QUANTITIES BY THE METHOD OF QUANTUM DISTRIBUTION FUNCTION. Yu.L.Klimontovich.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 6, 1033-6 (1956). In Russian.

Previous authors (Wigner, Phys. Rev., Vol. 40, 749, 1931; Moyal, Abstr. 3759/1949) have interpreted quantum mechanics as a statistical theory. This approach is re-assessed and the fundamental equations written in a way suitable for practical calculation. The computation of the energy levels of the hydrogen atom from the Schrödinger equation is carried through in the new formulation. J.W.Gardner

530.145

8599. MODIFICATION OF THE BRILLOUIN–WIGNER PERTURBATION METHOD. B.A.Lippmann.
Phys. Rev., Vol. 103, No. 5, 1149-50 (Sept. 1, 1956).

By using the method of Goldhammer and Feenberg, a simple, generally valid prescription for improving the Brillouin–Wigner perturbation procedure is derived. A.

530.145

8600. THE USE OF THE AIRY FUNCTIONS IN A POTENTIAL BARRIER PROBLEM. B.Jeffreys.
Proc. Cambridge Phil. Soc., Vol. 52, Pt 2, 273-9 (1956).

The exact solution for a trapezoidal potential barrier is given in terms of Airy functions and trigonometrical functions. Numerical values are found for the ratio of the amplitudes of the transmitted and reflected waves. These are compared with those given by the WKBJ approximation. A.

530.145 : 531.51

8601. POSSIBLE STATES OF A TWO-GRAVITON SYSTEM. V.A.Zhirnov and Yu.M.Shirokov.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1098-103 (1956). In Russian.

The proper functions of the angular momentum operator of two gravitons has been obtained. The state of a single graviton has been divided with respect to parity into a quasi-electric and quasi-magnetic states. The possible states of a two-graviton system have been investigated. The Klebsch-Jordan coefficients for S = 3 and S = 4 have been evaluated. A.

530.145

8602. ON THE S-MATRIX FOR PARTICLES WITH ARBITRARY SPIN. V.I.Karpman.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1104-11 (1956). In Russian.

Perturbation theory for particles with arbitrary spin is examined. Properties of singular functions for such particles are discussed. It is shown that the S-matrix elements can be obtained by use of the Feynman rules. A.

530.152

8603. A STATISTICAL THEORY OF LINEAR DISSIPATIVE SYSTEMS. II. N.Hashitsume.
Progr. theor. Phys, Vol. 15, No. 4, 369-413 (April, 1956).

For previous part, see Abstr. 8243 (1953). The statistical theory based on the probability of a given succession of non-equilibrium states of a linear dissipative systems given by Onsager and Machlup is proved by direct calculation to be equivalent to the theory of Brownian motion discussed by Wang and Uhlenbeck based on the Fourier series method of Rice. A function, which determines the above- mentioned probability and is constructed from the dissipation functions and the rate of entropy production, is shown to increase on the average with the lapse of time and remain constant (i.e., have the minimum value zero) when and only when the system obeys the phenomenological linear relations given by the thermodynamics of irreversible processes. This theorem is an extension of the second law of thermodynamics. When the system is characterized by a single relaxation time, the expression of the above-mentioned probability is a little simplified. The method of fluctuating distribution function is developed. When it is applied to the theory of the shape of collision broadened spectral line, the new strong collision treatment proposed by Gross is proved to give practically the same as that obtained by the theory of Brownian motion of harmonic oscillator. Finally, this method is applied to the fluctuation of electronic distribution in metals (the Johnson noise). The correlation function of electric current thus obtained is in accord with that given by Bakker—Heller and by Spenke. The correlation of heat flow and the cross correlation of electric current and heat flow are also given. A.

530.162

8604. THEORY OF FERMI LIQUIDS. L.D.Landau.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1058-64 (1956). In Russian.

A general theory of Fermi liquids is proposed, which is based on a concept of excitation energy being a functional of the distribution function. The effective mass of excitations, compressibility and magnetic susceptibility of the liquid are calculated. The kinetic equation is established and the expressions for the momentum and energy flows in the liquid are obtained. A.

530.162

8605. CONTRIBUTION TO THE GENERAL THEORY OF STATISTICAL EQUILIBRIUM OF A SYSTEM OF INTERACTING PARTICLES. A.E.Glauberman.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1084-91 (1956). In Russian.

Equations for the equilibrium distribution functions have been obtained from the general dynamical equations without assuming a canonical initial equilibrium distribution. Instead of this assumption a number of physical restrictions are imposed which are similar to the requirement of weakening of correlation with increasing distance between the particles. A.

GENERAL MECHANICS. MECHANICS OF SOLIDS 531

531.225

8606. TORSION OF PRISMATIC RODS OF U-SHAPED PROFILE. A.Hladík.
Czech. J. Phys., Vol. 5, No. 4, 502-14 (Dec., 1955). In Russian, with summary (200 words) in English.

The equations determining elastic equilibrium are solved by means of a Fourier expansion. Results are given in numerical tables and in the form of analytical expressions.
R.Eisenschitz

531.258 : 539.371

8607. THE PROBLEM OF MIXED BOUNDARY CONDITIONS FOR A RING-SHAPED BODY IN THE TWO-DIMENSIONAL THEORY OF ELASTICITY. F.Kroupa.
Czech. J. Phys., Vol. 6, No. 2, 124-40 (April, 1956). In Russian with summary (400 words) in English.

In studying the elastic distortion of solid rubber tyres, a cylindrical ring is considered which is part of an infinite cylindrical tube. As boundary conditions the stresses are given on the outer surface and the displacements on the inner surface; the latter are eventually assumed to be zero. Solutions of the equations of elastic equilibrium are obtained by an expansion procedure; as a result the stress distribution in the ring is derived. R.Eisenschitz

MECHANICAL MEASUREMENTS 531.7

531.717 : 537.531 : 535.34 : 541.135

8608. PLATING THICKNESS BY THE ATTENUATION OF CHARACTERISTIC X-RAYS. P.D.Zemany and H.A.Liebhafsky.
J. Electrochem. Soc., Vol. 103, No. 3, 157-9 (March, 1956).

X-rays strike a plated substrate metal and the rays emitted from the metal are attenuated by the surface layer and measured by a spectrograph with a good collimator and analysing crystal. The attenuation, due to absorption, is a measure of the plating thickness. Experimental results on iron foil coverings on zinc and zirconium substrates show that exponential absorption law is closely followed and indicate possibility of greater application of method in the future. Three different techniques are outlined and conclusions drawn as to their suitabilities in different conditions. E.D.Hart

MECHANICS OF FLUIDS 532

532.13 : 532.584

8609. THE EFFECTIVE VISCOSITY OF SUSPENSIONS OF SPHERICAL PARTICLES. G.J.Kynch.
Proc. Roy. Soc. A, Vol. 237, No. 1208, 90-116 (1956).

A method has been devised for solving the hydrodynamic problem involving swarms of particles moving in an incom-

pressible fluid, assuming that the inertia terms in the equation of motion can be neglected. It is used to calculate the effective viscosity of a suspension of spherical particles whose volume concentrations are less than 10%, assuming a statistical distribution of particles, under circumstances similar to those in a rotating viscometer. The viscosity is determined from the rate of shear at the walls. A special form of the model gives values of the effective viscosity up to concentrations as high as 25% which are in good agreement with experimental values. The mathematical treatment involves the calculation of the potential due to point charges amongst a collection of earthed conducting spheres, coinciding with the particles. The simpler approximations allowing only for the induced charge on these spheres and the dipole moments about their centres are sufficiently accurate for concentrations of less than 10%, but a more complicated estimate is required for greater concentrations, which includes the effect of quadrupole and other multipole moments. Such calculations are elaborate but they are completed by means of expansions in solutions of Laplace's equation $\nabla^2\phi = 0$ which are derivatives of the elementary solution $(1/r)$, instead of the more usual expansion in Legendre polynomials. A suitable algebra for these solutions is evolved which enables one to avoid problems which arise in changing the origin and axes of the Legendre polynomials. Using this algebra solutions of the equation $\nabla^2\phi = k^2\phi$ are manipulated almost as easily as those of Laplace's equation. In the final results for the effective viscosity, the effect of the multipoles is found to be small. A.

532.51

8610. CENTRIFUGAL MOTION. J.E.Verschaffelt.
Bull. Acad. Roy. Belgique Cl. Sci., Vol. 41, No. 7, 709-17 (1955). In French.

The mathematical treatment of the centrifugal motion of a mixed fluid (see abstract following) is extended with reference to a fixed or moving observer, and the laws of energy and entropy. J.S.G.Thomas

532.51

8611. CENTRIFUGAL MOTION. J.E.Verschaffelt.
Bull. Acad. Roy. Belgique Cl. Sci., Vol. 41, No. 9, 884-909, 910-16 (1955). In French.

Dealing with the centrifugal motion of a mixed fluid, it is shown, analytically, to be possible to derive the fundamental equations of motion of the fluid for the case of an observer in motion, from those deduced by a fixed observer. The flow of fluid along a curved tube is further discussed mathematically, the slight differences of the state of the fluid across the section of the tube being neglected. J.S.G.Thomas

532.51

8612. RELATIVE FLOW OF A FLUID. J.E.Verschaffelt.
Bull. Acad. Roy. Belgique Cl. Sci., Vol. 41, No. 10, 1106-12 (1955). In French.

Using the theory and method developed in the two preceding abstracts it is shown that in the mathematics of the motion of a fluid relative to a moving observer, temperature behaves as a specific magnitude, while pressure behaves as a concentrated magnitude. Volume of the fluid per unit mass is likewise a magnitude essentially specific in character. Attention is drawn to an apparent paradox relating to the acceleration of the fluid. J.S.G.Thomas

532.51 : 538.3

8613. MOTION OF A SPHERE THROUGH A CONDUCTING FLUID IN THE PRESENCE OF A STRONG MAGNETIC FIELD. K.Stewartson.
Proc. Cambridge Phil. Soc., Vol. 52, Pt 2, 301-16 (1956).

The steady motion of a perfectly conducting sphere in an inviscid conducting fluid in the presence of a strong magnetic field is discussed. It is shown that if the fluid velocity is ultimately steady then it is two-dimensional, and a cylinder $\mathscr{E}$ of fluid whose generators are parallel to the direction of the field moves with the sphere as if solid. The streamlines outside $\mathscr{E}$ are straight lines if the sphere moves in the direction of the field but have to execute sharp turns if it moves at right angles to the field. The motion to be expected in practice is discussed using an analogy. A.

532.51 : 538.3

8614. ENTRY OF CONDUCTING AND NON-CONDUCTING FLUIDS IN PIPES. J.A.Shercliff.
Proc. Cambridge Phil. Soc., Vol. 52, Pt 3, 573-83 (1956).

The problem of estimating the entry length over which the laminar motion of an electrically conducting, viscous fluid in a pipe under a transverse field adjusts to a steady state from some initial state is linearized by a Rayleigh approximation adapted for cases where there is a pressure gradient. Solutions are found which express the difference between the initial and ultimate velocity profiles as a series of orthogonal, exponentially decaying terms. Approximate entry lengths for the most persistent terms are calculated for flow between two infinite parallel planes and in rectangular tubes when magnetic effects are present. Entry lengths in circular and rectangular pipes and between infinite planes are calculated in the case where magnetic effects are negligible to permit a comparison of the results with those derived by other methods. Pressure losses at entry are considered in the simpler cases. A.

532.517

8615. SOLUTIONS OF THE EQUATIONS OF MOTION OF A VISCOUS, INCOMPRESSIBLE FLUID FOR TRANSIENT FLOW. J.Bass.
C.R. Acad. Sci. (Paris), Vol. 243, No. 3, 229-30 (July 16, 1956). In French.

The transient motion of a viscous, incompressible fluid within a limited convex region, bounded by a fixed surface, not necessarily a wall, is discussed mathematically, by deriving solutions of the Navier–Stokes equations. The nature of the motion is slightly influenced by the non-linear character of the equations. J.S.G.Thomas

CAPILLARITY 532.6

532.61

8616. GENERAL RELATION FOR CALCULATION OF TAMMANN CONSTANTS FOR DIFFERENT CONFINING MEDIA. R.C.Sill.
J. chem. Phys., Vol. 25, No. 2, 369 (Aug., 1956).

This is derived for the condition that the contact angles of the intersection of the solid/liquid interface with the confining surfaces are not zero. See Abstr. 3525 (1956). W.Good

MOLECULAR THEORY OF LIQUIDS 532.7

532.7

8617. THE KINETIC THEORY OF MONATOMIC LIQUIDS AT ORDINARY TEMPERATURES. G.H.A.Cole.
Rep. Progr. Phys., Vol. 19, 1-36 (1956).

In the last ten years new and successful attempts have been made at constructing a satisfactory theory of liquids which is able to include uniform or non-uniform conditions. For uniform systems the problem is the mathematical one of applying to the liquid state the well-established principles of statistical mechanics. For non-uniform systems, where the principles of statistical mechanics are inapplicable, the problem is first to derive principles of as wide validity for these systems as those of statistical mechanics for uniform systems. Solutions of both problems are now available which have led to quantitative calculations for monatomic liquids,

and which provide also semi-quantitative information for polyatomic liquids. This modern work is reviewed in the present article with a view to determining the achievements and deficiencies of the theory. It is concluded that at last a correct kinetic theory of monatomic liquids has been established which can be expected to lead to a full understanding of the liquid state. A.

532.7

8618. STUDY OF THE STRUCTURE OF A LIQUID SURFACE BY THE METHOD OF REFLECTION OF LIGHT. V.A.Kizel'. Zh. éksper. teor. Fiz., Vol. 29, No. 5 (11), 658-68 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 3, 520-9 (May, 1956).

Measurements of the elliptical polarization of light incident at Brewster's angle and reflected from the surface of a liquid were carried out for 60 liquids. The dependence of the effect on temperature was studied and its relation to the characteristics of a near-oriented arrangement is shown. A modification in the structure of the surface in the neighbourhood of the freezing point was revealed, and the connection of this phenomenon with supercooling. A.

532.7 : 534.22

VELOCITY OF SOUND IN LIQUIDS, LIQUID MIXTURES AND SOLUTIONS. See Abstr. 8050

532.77 : 535.345

8619. TEMPERATURE DEPENDENT ABSORPTION BY CH_3OH AND $CHCl_3$ IN THE 3 μ REGION. U.Liddel and E.D.Becker.
J. chem. Phys., Vol. 25, No. 1, 173-4 (July, 1956).

Measurements at various concentrations and temperatures in solutions in CCl_4 and CS_2 are in accord with monomer-polymer equilibrium of the solutes; temperature variations for dilute solutions indicate a specific interaction, analogous to hydrogen bonding, between solvent and solute. G.F.Lothian

MECHANICS OF GASES 533

533.15 : 539.155.4

8620. THERMAL DIFFUSION IN KRYPTON AND ARGON. J.W.Corbett and W.W.Watson.
J. chem. Phys., Vol. 25, No. 3, 385-8 (Sept., 1956).

The mathematical description of a two-bulb thermal diffusion experiment is extended to the case of multicomponent isotopic mixtures. A self-consistent method of comparing two-bulb data with theoretical predictions is developed and applied to the argon data of Stier. The best fit for the modified Buckingham exp-six, $\alpha = 14$, intermolecular potential model is obtained for a force constant, $\epsilon/k = 110^\circ$K. Measurements of the thermal diffusion factor of krypton v. temperature are presented and compared to the Lennard–Jones (9, 5) and (13, 7) and the modified Buckingham exp-six, $\alpha = 14$ models, yielding the force constant values, $\epsilon/k = 169$, 395 and 470°K, respectively. A.

533.15

8621. ON THE USE OF PALLADIUM DIFFUSION MEMBRANES FOR THE PURIFICATION OF HYDROGEN. D.W.Juenker, M.van Swaay and C.E.Birchenall.
Rev. sci. Instrum., Vol. 26, No. 9, 888 (Sept., 1955).

An experimental investigation of the properties of palladium is discussed with regard to objections (Abstr. 1587/1955) to the use of palladium for hydrogen purification. The results obtained are compared with the published values for the permeability of nickel. H.C.Cole

533.15 : 539.155.2

A COUNTERCURRENT GASEOUS DIFFUSION PROCESS: THEORY OF THE SEPARATION AT EQUILIBRIUM. See Abstr. 8338

533.5

8622. DEVICE FOR THE PRODUCTION BY LAZY-TONGS OF STRAIGHT LINE TRANSLATORY MOTION WITHIN A VACUUM. E.Thomas.
Bull. Acad. Roy. Belgique Cl. Sci., Vol. 41, No. 8, 839-41 (1955). In French.

A screw controls the movement of a piston, surrounded by a metal bellows forming the vacuum joint, which opens or closes a pair of lazy-tongs within the vacuum chamber. A sectional drawing of the all-metal arrangement is given. S.Weintroub

533.6.011.5

8623. ON THE HYPERSONIC VISCOUS FLOW PAST SLENDER BODIES OF REVOLUTION. M.Yasuhara.
J. Phys. Soc. Japan, Vol. 11, No. 8, 878-86 (Aug., 1956).

A similar solution of the hypersonic viscous flow past slender bodies of revolution is deduced for a special case when the radial coordinate of the body surface at section x is proportional to $x^{3/4}$, where the radial coordinate has a value of an order with the thickness of the boundary layer. Here, "similar" is used in the direct meaning that distributions in the boundary layer have a similar form lengthwise. Calculations are accomplished for the region of strong interaction between the boundary layer and the shock wave. From several calculations it may be expected that if the thickness of the body becomes small, the thickness of the layer in which the longitudinal velocity component u is rapidly decreased also becomes small, and in the major part of the boundary layer, only the normal component v is increased. Further, if the thickness of the body is increased, then, the height of the shock wave, the pressure on the wall, and the shear stress at the wall are also increased, while the boundary layer thickness is decreased. The nose region is excluded by the reason that the ordinary boundary layer theory will be invalid there. A.

VIBRATIONS. ACOUSTICS 534

534.2 : 535.12 : 538.566

8624. ASYMMETRIC INTERFERENCE WAVES IN A LAYERED MEDIUM. V.I.Keĭlis-Borok.
Dokl. Akad. Nauk SSSR, Vol. 107, No. 4, 533-6 (1956). In Russian.

Earlier work (V.I.Keĭlis-Borok, Dokl. Akad. Nauk SSSR, Vol. 87, No. 1, 25, 1952; Vol. 95, No. 4, 733, 1954) on axially symmetric interference waves in a multi-layered semi-space is generalized to include non-symmetric oscillations. For the latter the displacement divides into waves of two types composed of different numbers of harmonics and distinguished in dispersion and resonance properties. Waves of the first type are analogous to the axially symmetric waves. The displacements lie in a vertical radial plane. Waves of the second type have horizontal tangential displacements; in special cases they are Love waves. A.L.Mackay

534.2

8625. WAVE PROPAGATION IN RODS OF VOIGT MATERIAL AND VISCO-ELASTIC MATERIALS WITH THREE-PARAMETER MODELS. J.A.Morrison.
Quart. appl. Math., Vol. 14, No. 2, 153-69 (July, 1956).

The problem of an impulsively applied and subsequently maintained constant velocity at the end of a semi-infinite rod of Voigt material is considered and integral expressions are obtained for the velocity and stress distributions in the rod. Apart from a constant factor the stress distribution arising

from an impulsively applied constant stress at the end of the rod is the same as the velocity solution above. The same problem is considered also for materials with three-parameter models. The stress distribution for both the case of constant applied stress and constant applied velocity are represented graphically for the materials considered, dimensionless coordinates being used. A.

534.2 : 550.341

8626. PROPAGATION OF RAYLEIGH WAVES IN TRANSVERSELY ISOTROPIC MEDIUM IN THREE DIMENSIONS. S.C. Das Gupta.
Trans Amer. Geophys. Un., Vol. 36, No. 4, 675-8 (Aug., 1956).

It has been found that the frequency equation is the same as in two dimensional case. It has been shown that in case of ordinary crystals, there is only one real root of the frequency equation which satisfies the necessary boundary conditions. A.

534.2 : 539.31

POLARIZATION OF ELASTIC WAVES. See Abstr. 8435

534.213

8627. EQUIVALENT CIRCUIT FOR SPHERICAL RADIATION IN A SOLID. V.Salmon.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 724-5 (July, 1956).

Reference is made to a paper by F.G.Blake (Abstr. 3386/1952) who derives the radiation impedance for a spherical cavity radiating compressional waves into a surrounding infinite solid. The equivalent electrical circuit is shown. Although this contains no more information than the analytical expressions, it does permit rapid qualitative estimates of behaviour for a variety of input functions. It is shown that radiation resonance may occur in solids, but not in fluids. The resonance frequency decreases from infinity to zero as Poisson's ratio σ changes from $\frac{1}{3}$ to $\frac{1}{2}$. A.B.Wood

535.214 : 534.232

ON THE THEORY OF THE MICROPHONE CHAMBER OF VEINGEROV'S SPECTROPHONE AND THE OPTICO-ACOUSTICAL GAS ANALYSER. See Abstr. 8632

534.22/.23 : 541.64

8628. TEMPERATURE DEPENDENCE OF VELOCITY AND ATTENUATION OF ULTRASONIC WAVES IN HIGH POLYMERS. Y.Wada and K.Yamamoto.
J. Phys. Soc. Japan, Vol. 11, No. 8, 887-92 (Aug., 1956).

Measurements of velocity and attenuation of ultrasonic waves are carried out for polystyrene, polymethyl methacrylate, phenol resin, polyethylene, Nylon 6 and other commercial resins in the temperature from -60°C to 90°C and at frequencies of 100 kc/s, 1.46 Mc/s, 4.38 Mc/s and 7.30 Mc/s. A correlation between sound velocity in the megacycle range and density is pointed out for glassy polymers. In the case of linear polymers, the temperature coefficient of ultrasonic velocity, β, exhibits a relatively abrupt change in the glass transition region at the temperature T_m, independent of sound frequency, and agreeing with the transition point associated with thermal expansion. The ratio of β to volume expansion coefficient α is found to be constant below and above T_m for each polymer. These facts indicate that the change in β at T_m should be ascribed to the temperature dependence of intermolecular free volume. For some polymers a change in β and a peak of loss factor are observed at lower temperatures. A.

534.22

8629. NOVEL USES OF THE ULTRASONIC LIGHT CELL. N.B.Terry, H.Mumford and D.G.Holloway.
A.T.E. J., Vol. 11, No. 1, 2-16 (Jan., 1955).

The action of the cell is described, its use as a filter is discussed and the amplitude/frequency characteristic for a simple slot mask is given. The schlieren nature of the optical system is illustrated with photographs of the ultrasonic beam and a crystal dissolving in water. The use of the ultrasonic light cell for pulse shaping and wave correction is illustrated with photographs of pulses obtained during the experimental investigation, and finally some of the limitations of the apparatus are discussed. A novel method of measuring ultrasonic velocities in liquids is described. Its possible use for measuring attenuation is suggested. Results obtained for the ultrasonic velocity in fractionated heptane are given, and compared to values obtained by a standard method. A.

534.23

8630. THEORY OF THE ULTRASONIC ABSORPTION IN AQUEOUS SOLUTIONS. I. INTRODUCTION AND GENERAL THEORY. O.Nomoto.
J. Phys. Soc. Japan, Vol. 11, No. 8, 827-40 (Aug., 1956).

The origin of the anomalous ultrasonic absorption in aqueous solutions has been attributed to the rearrangement process between the associated and the single molecules of water and the solute molecules accompanying the acoustic cycle. The excess pressure of the sound wave changes the existence ratio between the associated and the single molecules of water and gives rise to the molecular rearrangement. This process accompanies a change in configurational entropy, the entropy increasing in the compressed volume element. This entropy increase is approximately reversible, becoming perfectly reversible in the quasi-stationary limit. This reversible increase ΔS in entropy, however, requires a heat quantity $T\Delta S$ (T = absolute temperature), which must be supplied by the volume element itself. Thus the specific heat apparently increases by an amount C_m, which corresponds to the specific heat of the internal degrees of freedom of the molecules by the molecular absorption of sound. The main part of ΔS is due to the diffusion of the solute molecules into the groups of single water molecules formed by the collapse of the associated molecules of water under excess pressure, the relaxation time of this diffusion corresponding to the relaxation time of the internal energy in the molecular absorption of sound. A general formula for anomalous ultrasonic absorption in aqueous solutions has been obtained along these lines and under appropriate assumptions. A.

534.23 : 536.75

IRREVERSIBLE PRODUCTION OF ENTROPY AND THE ABSORPTION OF SOUND. See Abstr. 8752

534.232

8631. ULTRASONIC RADIATOR MADE OF NICKEL FERRITE. I.P.Golyamina.
Akust. Zh., Vol. 2, No. 2, 225-8 (April-June, 1956). In Russian.

Paper describes the construction of a small Ni ferrite transducer and gives its power–frequency and acoustic pressure–exciting voltage characteristics. The Ni ferrites have considerable interest for such applications since their magnetostriction saturation is high, they exhibit very moderate hysteresis and their coefficient of magneto-mechanical coupling is comparable with that of Ni. C.R.S.Manders

534.232 : 535.214

8632. ON THE THEORY OF THE MICROPHONE CHAMBER OF VEĬNGEROV'S SPECTROPHONE AND THE OPTICO-ACOUSTICAL GAS ANALYSER. A.O.Sall'.
Zh. tekh. Fiz., Vol. 26, No. 1, 157-74 (1956). In Russian.

Veĭngerov's optico-acoustical method (M.L.Veĭngerov, Dokl. Akad. Nauk SSSR, Vol. 19, 687, 1938; Zavodskaya Laboratoriya, 4, 1947) consists of the measurement of the sound pressure produced by pulsed infrared irradiation of a gas or vapour enclosed in a microphone chamber. The present work is concerned with the theoretical investigation of the process of absorption of infrared radiation by the gas, excitation of acoustical oscillations (a rigorous solution is given for a rigid cylindrical chamber) and selection of optimum microphone chamber dimensions, obturation frequency, and chamber filling. A.Gelbtuch

535.241 : 551.594.5 : 551.521.326

A PHOTOMETRIC UNIT FOR THE AIRGLOW AND AURORA. See Abstr. 9114

535.247.4 : 551.594.5 : 551.521.3

A NEW TYPE OF NIGHTGLOW-AURORAL PHOTOMETER. See Abstr.9111

534.3

8633. ON THE DESIGN AND CONSTRUCTION OF ORGANS ON ACOUSTIC PRINCIPLES. W.Lottermoser.
Z. Naturforsch., Vol. 11a, No. 6, 516-17 (June, 1956). In German.

Using a DIN sound intensity meter equipped with octave filters, measurements have been made on various organs in churches in Germany. The results are shown in diagrammatic form. The bearing of these observations is discussed in relation to the design of organs. A useful list of references to the work of other authors is also included in the paper.
A.B.Wood

534.321 : 534.24

8634. WOBBLING OF AN AUDIO NOTE DUE TO A ROTATING TARGET. M.V.J.Row and S.R.Rao.
J. Instn Telecomm. Engrs (New Delhi), Vol. 2, No. 2, 100-2 (March, 1956).

An analytical treatment of the effect of a rotating target on a pure a.f. note of a steady level and frequency. The theory postulated predicts a rise and fall in the frequency of the note concerned, as a function of the parameters of the target for every complete rotation; the recurrence of the phenomenon per second is therefore numerically equal to the revolutions per second of the target involved. Other factors remaining identical, the frequency deviation caused is proportional to the frequency of the original note itself. From another perspective it also suggests that the wobbling may only be due to a periodic fluctuation in the intensity of the original signal, caused by interference with the target reflected echoes. From mathematical analysis, a signal of constant frequency but varying amplitude readily yields other frequency components, symmetrically situated on either side of the original. The resultant would then be a combinational tone. That the effect is not merely subjective but has an objective reality is confirmed by the fact that the undulations are picked up by a microphone in the field.
A.

534.6

8635. SUGGESTION ON REFERENCE QUANTITIES FOR POWER LEVELS. L.L.Beranek.
J. Acoust. Soc. Amer., Vol. 28, No. 4, 725-6 (July, 1956).

Young (Abstr. 5741/1956) has concluded that 10^{-12} W is a better single choice of reference power level than 10^{-13} W. The present note reviews briefly some of the history which led to the present choice of 10^{-13} W as a reference level, showing how it arises from the use of the English system of units by engineers and architects.
G.F.Hodsman

534.7

PHYSIOLOGICAL ACOUSTICS. HEARING. See also under "Medical science. Human physiology". Decimal classification 612.85.

534.78 : 612.85

8636. RELATIONS BETWEEN AUDITION AND PHONATION. A.Tomatis.
Ann. Télécomm., Vol. 11, No. 7-8, 151-8 (July-Aug., 1956). In French.

Objective audiometry as at present practised re-opens the question of the relations which connect the circuit of audition—phonation. It would appear that such relations cannot survive without the existence of audition. The author examines this point in particular relation to deaf-mutes. It is shown that all perturbations of the audition—phonation circuit are immediately detectable by the troubles which they entrain whether in rhythm or in pitch or quality.
A.B.Wood

534.836

8637. SURFACE TRANSPORTATION NOISE — A REVIEW. V.Salmon.
Noise Control, Vol. 2, No. 4, 21-7, 94 (July, 1956).

534.842

8638. ACOUSTICS OF LARGE AUDITORIA. R.Lamoral.
Onde élect., Vol. 36, 416-18 (May, 1956). In French.

The study of large halls can be sub-divided as follows: (1) investigation of optimum reverberation time by the application of classical methods (Sabine, Eyring, Millington) and of the designer's own experience; (2) investigation of the shape of the halls, which may be carried out graphically, or preferably with the aid of models; (3) the determination of the absorption of sound energy corresponding to that for the eventual use of the hall; and (4) final design giving the desired sound insulation.
A.

534.844

8639. NEW ACOUSTIC CHARACTERISTIC OF ROOMS AND THE DEVELOPMENT OF A MULTI-PURPOSE ELECTRONIC COUNTER. R.Lamoral and R.Trembasky.
Onde élect., Vol. 36, 441-9 (May, 1956). In French.

The article presents a new conception and apparatus suitable for measuring it. It appears that the classical reverberation time is insufficient to define the acoustic characteristics of a room and the idea of diffusion as an index, which is a function of frequency, is advanced. The apparatus described is primarily intended to measure this index, but in the course of its development it appeared to be useful for making other measurements, e.g., time of reverberation, sonometer, sound insulation, damping irregularities, etc.
A.

534.862 : 621.395.625.3

8640. AN ACOUSTIC TIME REGULATOR FOR SOUND RECORDING. A.M.Springer.
Elektrotech. Z. (ETZ) B, Vol. 8, No. 3, 93-6 (March 21, 1956). In German.

The principles of operation of this device, which have recently been described (Abstr. 3590/1956) are briefly reviewed. Maintenance of the fixed relative speed of tape and heads and, at the same time, control of their absolute speeds are best achieved by the use of a synchronous motor with rotating stator and rotor, the tape being driven from one and the heads from the other. The speed of the external rotor is controlled by a variable-ratio friction coupling driven from a fixed-speed auxiliary motor. It is possible to eliminate the auxiliary motor but the absolute speeds cannot then be guaranteed. An auxiliary unit for use with a standard magnetophone equipment is briefly described.
H.G.M.Spratt

OPTICS. RADIATION. SPECTRA 535

535.242 : 535.822

8641. ADAPTATION OF A PROJECTION MICROSCOPE FOR MICROPHOTOMETRY. D.H.Tomlin and F.J.Fayers.
J. sci. Instrum., Vol. 32, No. 10, 404-5 (Oct., 1955).

A standard Vickers projection microscope may be simply modified for use as a microphotometer of high resolution. With an exit slit 0.1 mm wide, the upper limit of magnification attainable is x 300, with a limiting resolution of 3 micron.
D.R.Barber

535.247

8642. MEASUREMENT OF THE LUMINOUS FLUX FROM SOURCES OF LIGHT: SELECTION AND PROPERTIES OF THE WHITE PAINT USED IN A PHOTOMETRIC SPHERE. J.Terrien.

Bull. Soc. Franç. Elect., Vol. 6, 307-12 (May, 1956). In French.

The paint used for an integrating sphere must be a good diffuser, non-selective and of a high reflection factor and many different formulae have been used. The author advocates the use of powdered ZnO or $BaSO_4$ with an aqueous solution of carboxymethylcellulose as vehicle. A small amount of ivory black is added to reduce the reflection factor to about 0.85, the value most suitable for general work. The reflection factor of a paint and its selectivity may be measured by using a small sphere of some 10 cm dia. and by this means it is shown that the paint suggested is very non-selective over the whole of the visible spectrum except at the very ends. J.W.T.Walsh

535.247 : 771.534.5

8643. DEVICE FOR USE WITH A NON-RECORDING MICROPHOTOMETER. G.L.Rogers.
J. sci. Instrum., Vol. 32, No. 9, 366 (Sept., 1955).

The microphotometer is fitted with a motor drive and a gear train which gives an audible signal at regular distances (e.g. 25 μ) along the plate scan. The reading is noted at each signal and in this way it is possible to treble the speed of scan over purely manual operation.

535.247 : 771.534.5

8644. LOGARITHMIC DEVICE FOR A DENSITOMETER. D.T.R.Dighton.
J. sci. Instrum., Vol. 32, No. 10, 404 (Oct., 1955).

A thermionic diode, when coupled to a linear valve-voltmeter in the output circuit of a conventional direct-reading photoelectric (vacuum cell) densitometer, provides compensation for fluctuating supply voltages, and enables a linear density-calibration of the reading-dial to be made. D.R.Barber

535.316/.317

8645. NEW LENS SYSTEMS. C.G.Wynne.
Rep. Progr. Phys., Vol. 19, 298-325 (1956).

After an introductory discussion of the elementary aberration theory of corrected optical systems, and some consideration of new optical materials and processes, recent forms of optical imaging systems are described; most of these are systems of spherical refracting surfaces; aspheric and reflecting systems are also included. A.

535.317

8646. A STUDY OF THE PRELIMINARY PARAXIAL DESIGN OF TRIPLETS AND THE INFLUENCE OF THE INDIVIDUAL ELEMENTS ON THE STATE OF CORRECTION OF THE IMAGE. J.Barcala and D.Vázquez.
An. Real Soc. Espań. Fís. Quím., Vol. 52 (A), No. 3-4, 59-64 (March-April, 1956). In Spanish.

The equations for the total power, Petzval sum, and chromatic aberrations are derived for a symmetrical triplet. Values are calculated for a number of glass types, separations and powers of the positive elements. R.W.Fish

535.317

8647. MEANS OF CALCULATING THE POWERS OF A RELAY LENS OF TRIPLET TYPE. J.Barcala and D.Vázquez.
An. Real. Soc. Espań. Fís. Quím., Vol. 52 (A), No. 5-6, 101-4 (May-June, 1956). In Spanish.

The equations governing the total power of the system and the achromatism are formulated in terms of the positive power and the air space. Graphs are given allowing the other parameters to be determined. R.W.Fish

535.323

8648. ON THE POSSIBILITY OF MEASURING THE REFRACTIVE INDEX OF CRYSTALLINE MATERIALS ON AN ABBE-TYPE REFRACTOMETER. F.Nechaĭ.
Zh. tekh. Fiz., Vol. 26, No. 2, 436-8 (1956). In Russian.

It is possible to measure the refractive index using a liquid which gives optical contact and is poured onto the prisms of the refractometer where the small crystals are placed. If a brittle substance is used it must however be crystallized onto the refractometer prisms. J.Jacobs

535.33 : 551.594.5

TRANSITION PROBABILITIES OF AURORAL LINES. See Abstr. 9144

535.33.07 : 535.417

8649. SPECTROPHOTOMETRY BY MEANS OF THE FABRY–PEROT INTERFEROMETER. P.Jacquinot and R.Chabbal.
J. Opt. Soc. Amer., Vol. 46, No. 7, 556-7 (July, 1956).

The principal functioning properties of the Fabry–Perot recording spectrophotometer are summarized. Attention is drawn to the extensive former literature. Aspects discussed include (a) luminosity (b) integral use (c) linear continuous exploration. It is pointed out that already there are in existence several successfully operating recording Fabry–Perot spectrometers. Some include two synchronized Fabry–Perot interferometers. S.Tolansky

535.33.07 : 551.594.5

A SLITLESS SPECTROGRAPH DESIGNED TO PHOTOGRAPH THE SPECTRA OF AURORAE. See Abstr. 9145

535.331

8650. INTERFEROMETRIC WAVELENGTH MEASUREMENTS OF GERMANIUM LINES OF A HOLLOW CATHODE DISCHARGE. R.D.VanVeld and K.W.Meissner.
J. Opt. Soc. Amer., Vol. 46, No. 8, 598-604 (Aug., 1956).

Interferometric wavelength measurements of forty-three germanium arc lines in the region from 4685 A to 2019 A have been performed. The light source used was a hollow cathode Schüler tube of special design employing a cast germanium cathode provided with a slot. The precision measurements carried out by means of a Fabry–Perot interferometer equipped with 6, 20, 36, and 49 mm spacers show that the germanium lines emitted by this source are of superior quality and merit use as secondary standards. The measurements were employed for the establishment of precision values for one even energy level and for eighteen odd levels. Furthermore, by application of Ritz's combination principle and by using the term analysis of the spectrum it was possible to calculate precisely the wavelength values of twenty-nine germanium lines in the vacuum region between λ1998 A and λ1691 A. These lines can be recommended as reliable standards in this wavelength region. A.

535.332 : 551.594.5

8651. THE CALCULATION OF CROSS-SECTIONS FOR EXCITATION OF FORBIDDEN ATOMIC LINES BY ELECTRON IMPACT. M.J.Seaton.
Airglow and the aurorae (Belfast) 289-301. See Abstr. 7088 (1956).

Outlines the methods used, summarizes the results obtained, and discusses their probable accuracy. A.

535.332

8652. TRANSITION PROBABILITIES FOR SOME LINES OF N II. R.J.McCarroll and P.G.Wakely.
Airglow and the aurorae (Belfast) 337-9. See Abstr. 7088 (1956).

Hartree–Fock wave-functions have been obtained for the $(3d)\ ^3P$, $(3d)\ ^3D$, $(3d)\ ^3F$, $(3p)\ ^3P$ and $(3p)\ ^3D$ terms of N II, and from these wave-functions various transition probabilities have been computed, using both the dipole-length and dipole-velocity form of the transition integral. The two forms give satisfactory agreement and provide a basis on which to estimate the validity of the Coulomb approximation of Bates and Damgaard. A.

535.332 : 551.594.5

THE LABORATORY EXCITATION OF AURORAL INFRA-ED OI LINES. See Abstr. 9143

535.333

353. EMISSION BAND SPECTRA OF NITROGEN. THE IFTH POSITIVE SYSTEM. A.Lofthus.
chem. Phys., Vol. 25, No. 3, 494-7 (Sept., 1956).

19 bands of the fifth positive system of nitrogen have been notographed in the second and third orders of a 21 ft grating pectrograph. Vibrational and rotational analyses gave the llowing results: (1) $x^1\Sigma_g^-$ state: $B_e = 1.750$, $\alpha_e = 0.022\,5$, $e = 6 \times 10^{-6}$, $T_e = a' + 45\,284.7$, $\omega_e = 1910$, $\omega_e x_e = 20.7$, $\lambda = 1.168$ A; (2) $a' {}^1\Sigma_u^-$ state: $B_e = 1.480$, $\alpha_e = 0.0164$, $e = 6 \times 10^{-6}$, $T_e = a'$, $\omega_e = 1530$, $\omega_e x_e = 12.0$, $\omega_e y_e = 0.033$, $\lambda = 1.270$ A. An anomalous intensity distribution in the v' = 0 nds was observed. A.

535.333 : 551.594.5

654. ELECTRON EXCITATION FUNCTIONS OF N_2^+ BANDS. .T.Stewart.
irglow and the aurorae (Belfast) 283-6. See Abstr. 7088 1956).

The optical excitation functions of some N_2^+ bands have een determined. The maximum of intensity of the Meinel ands ($A^2\Pi - X^2\Sigma_g^+$) occurs at 60 V, while that of the first egative bands ($B^2\Sigma_u^+ - X^2\Sigma_g^+$) occurs at 95 V. A.

535.333 : 551.521.3 : 551.594.5

655. MOLECULAR BAND INTENSITIES AND THEIR NTERPRETATION. R.W.Nicholls.
irglow and the aurorae (Belfast) 302-23. See Abstr. 7088 1956).

A description of recent work on molecular transition robabilities, and their use in interpreting spectra in terms f source conditions. Basic concepts, and Franck–Condon actors are discussed. The interpretation of molecular band ntensities in terms of relative transition probabilities, and ariation of electronic transition moment with internuclear eparation, is dealt with: and the results are applied to four and-systems of geophysical interest, viz. First Positive, nd Second Positive of N_2; First Negative of N_2^+; and chumann–Runge system of O_2. A method by which eye-stimates of band intensities may be treated quantitatively s also outlined. D.R.Barber

535.333 : 551.521.3

A LABORATORY SOURCE OF THE HERZBERG BANDS F O_2. See Abstr. 9103

535.333 : 539.132

656. THE EMISSION SPECTRUM OF THE BiO MOLECULE. .Scari.
cta phys. Hungar., Vol. 6, No. 1, 73-85 (1956). In German.

The spectrum has been photographed in the region 500-8300 A. The bands degrade to the red, and include everal not previously reported (Indian J. Phys., Vol. 18, 82-6, June, 1944). A new vibrational analysis is given and he equation fitting the wave numbers of the band heads is evised. The mean values for the vibration constants of the round state are $\omega_e = 693.25$ cm^{-1}, $\omega_e x_e = 4.35$ cm^{-1} and $D_e = 3.69 \pm 0.90$ eV. G.Allen

535.333 : 551.521.3

THE REACTION OF ATOMIC HYDROGEN WITH OZONE. ee Abstr. 9104

535.333 : 551.594.5

LABORATORY STUDIES OF AURORAL EXCITATION. ee Abstr. 9142

535.338.32

657. THE INFLUENCE OF RADIATION-DIFFUSION ON HE INTENSITY RATIO OF THE ALKALI RESONANCE LINES. .Seiwert.
Ann. Phys. (Leipzig), Vol. 17, No. 6-8, 371-88 (1956). In German.

In some experiments on transfer of excitation energy the occurrence of radiation diffusion within the resonance vessel is unavoidable. A certain density distribution of excited atoms arises under the influence of this radiation diffusion and of the impulses leading to transitions between the two resonance states. Two integral equations are established to determine this density distribution, from which the intensity ratio of the resonance lines can be derived. A section follows indicating the solution of the equations and discussing the integrals which arise. J.Jacobs

535.338.33

8658. THE ISOTOPE SHIFT IN THE RESONANCE LINES OF Yb II AND IN THE SINGLET SYSTEM OF Yb I.
K.Krebs and H.Nelkowski.
Z. Phys., Vol. 45, No. 5, 543-59 (1956). In German.

A detailed study of the hyperfine structure, for the lines Yb II (3289 A), $6s^2S_{1/2} - 6p^2P_{3/2}$, Yb I (6668 A), $6s6p^1P_1 - 6s6d^1D_2$, and Yb I (3988 A), $6s^2\,{}^1S_0 - 6s6p^1P_1$. Some data on the Doppler broadening and given for the last line. The energy level systems are given, with full discussion. J.D.Craggs

535.338.332

8659. RELATIVE INTENSITY OF THE COMPONENTS OF THE FINE STRUCTURE OF THE He II 4686 A LINE.
P.S.Kireev.
Dokl. Akad. Nauk SSSR, Vol. 106, No. 4, 630-2 (1956). In Russian.

Using Fabry–Perot etalons of 2.0 mm and 2.5 mm spacing, the intensity curves for the 4686 A line were determined with the gas at a pressure of 0.5 mm. Previous authors while measuring the separation of the components have not measured their intensities although Dirac's theory enables these to be calculated. Tables are given of the calculated and measured intensities. Anomalies in some of the measured intensities are discussed in terms of the effect of the gas pressure upon the excitation of the particular component. W.Bardsley

535.338.333

8660. ISOTOPE SHIFT IN THE SPECTRUM OF He II.
P.S.Kireev.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 3, 427 (1956).

The measurement is carried out with a Fabry–Perot etalon and yields for the $n = 4 \rightarrow n = 3$ line a difference $\delta\nu = 0.932$ cm^{-1} between He^3II and He^4II, significantly different from the theoretical value. G.E.Brown

535.338.334

8661. EFFECT OF RE-ABSORPTION ON THE WIDTH OF SPECTRUM LINES. L.M.Biberman and E.M.Novodvorskaya.
Dokl. Akad. Nauk SSSR, Vol. 106, No. 1, 35-8 (1956). In Russian.

Develops a formula for the line width in the case of simultaneous Doppler and impact-induced broadening, and an approximate formula for high optical densities. Results of Vyat-skin and Nagibina's research (Dokl. Akad. Nauk SSSR, Vol. 98, No. 1, 59, 1954) on the dependence of the form of a.c. arc lines on the concentration of admixtures were found to fully agree with those calculated from the general formula. The observed and calculated linear increase of the line width cannot be explained solely by the broadening of the line of a single atom, brought about by resonance interaction with other atoms of the same element; this could only account for $10^{-5} - 10^{-4}$ of the broadening observed. On the other hand, auto-absorption fully explains this broadening. The linear portion of the width-increase curve makes it possible to develop a method of determining the concentration of emitting atoms in the source. F.Lachman

535.34 : 548.7

8662. OPTICAL ABSORPTION IN COMPOUNDS OF METALS OF THE FIRST AND SECOND GROUP OF MENDELEEV'S TABLE AND THE ENERGY OF THE CRYSTALLINE LATTICE. A.A.Vorob'ev.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 1, 47-8 (1956). In Russian.

It is shown that for any one metal from groups I and II of the periodic table smooth graphs can be obtained by plotting lattice energy against (i) the ultraviolet absorption edge, (ii) the maximum of the F-centre absorption or (iii) the infrared lattice absorption the variable being the nature of the halogen in each case. D.H.Whiffen

535.34

8663. REMARKS ON INSTRUMENTATION IN THE FAR INFRARED. A.Hadni.
J.Phys.Radium, Vol. 17, No. 3, 311-12 (March, 1956). In French.

Some comments on a review by M.C.Haeusler (Abstr. 1051/1956) particularly on the removal of stray radiation and on the possibility of using instruments of large relative aperture with wide slits. G.F.Lothian

535.343 : 541.14

ABSORPTION SPECTRA OF FREE RADICALS PRODUCED BY FLASH DISCHARGES. See Abstr. 9016

535.343 : 539.133

8664. ELECTRONIC SPECTRUM AND STRUCTURE OF THE FREE NH_2 RADICAL. D.A.Ramsay.
J. chem. Phys., Vol. 25, No. 1, 188-9 (July, 1956).

Using an improved technique (J. Opt. Soc. Amer., Vol. 32, 285, 1942) to obtain the absorption spectra of $N^{14}H_2$ and $N^{15}H_2$, analysis of the observed bands is possible. Geometrical parameters for the NH_2 group are deduced. G.I.W.Llewelyn

535.343 : 538.615

8665. ABSORPTION SPECTRA, ZEEMAN EFFECTS, AND MAGNETIC PROPERTIES OF NEODYMIUM SALTS. G.H.Dieke and L.Heroux.
Phys. Rev., Vol. 103, No. 5, 1227-39 (Sept. 1, 1956).

The absorption spectra of nine neodymium salts were obtained in single crystals at liquid helium temperature and high dispersion. The Zeeman effect of the lines was observed in a field of about 37 000 gauss with different orientations of the crystals, so that the magnetic splitting of the ground and excited states could be measured. This provides valuable clues for the interpretation of the spectra and quantitative data for the derivation of the crystal field. The results are related to those obtained in paramagnetic resonance measurements. A.

535.343 : 548.7

8666. THE ABSORPTION SPECTRA OF IRRADIATED DIAMONDS AFTER HEAT TREATMENT. C.D.Clark, R.W.Ditchburn and H.B.Dyer.
Proc. Roy. Soc. A, Vol. 237, No. 1208, 75-89 (1956).

The absorption spectra of eight type I and three type IIa diamonds irradiated with neutrons, electrons or γ-rays have been recorded at 80 and 290°K after various heat treatments in the temperature range 0 to 900°C. It is found that heating in the range 350 to 450°C causes a general reduction in the irradiation-induced absorption owing to the recombination of those interstitials and vacancies which are near neighbours. Heating type IIa diamonds at 600°C causes a large reduction in the irradiation-induced lines and new lines appear. These are probably due to pairs of identical defects, and the kinetics of their formation during isothermal heating at 600°C are presented. At higher temperatures all absorption lines in type IIa diamonds disappear and only continuous absorption remains. This is probably due to amorphous or graphitic regions produced by agglomeration of defects. Type I diamonds show the same kind of absorption, but in addition show an increase in strength of the natural lines and also some new absorption lines which are not removed by heating at 900°C. It is suggested that these additional processes are due to the anchoring of vacant atomic sites and interstitial carbon atoms at crystal imperfections present only in type I diamonds. A.

535.343

8667. OBSERVED $n \rightarrow \pi^*$ BANDS IN THE ULTRAVIOLET ABSORPTION SOLUTION SPECTRA OF THE DI-AZA-NAPHTHALENES. R.C.Hirt, F.T.King and J.C.Cavagnol.
J. chem. Phys., Vol. 25, No. 3, 574-6 (Sept., 1956).

Weak bands have been observed in the ultraviolet absorption solution spectra of phthalazine, quinoxaline, 6-chloroquinoxaline and 6-bromoquinoxaline, which show "blue-shifts" in a more polar solvent sequence. They, along with similar reported bands in cinnoline, have been assigned as $n \rightarrow \pi^*$ bands analogous to those of the diazines and triazines. A.

535.343

8668. ON THE ABSORPTION SPECTRA OF COMPLEX IONS. III. THE CALCULATION OF THE CRYSTALLINE FIELD STRENGTH. Y.Tanabe and S.Sugano.
J. Phys. Soc. Japan, Vol. 11, No. 8, 864-77 (Aug., 1956).

A molecular calculation of the crystalline field parameter D9 in chrome alum has been carried out on the basis of the generalized crystalline field model suggested in Pts I and II (Abstr. 2591-2/1955). The deformation of the electron cloud of Cr^{3+} is taken into consideration by making the 3d orbital of Cr^{3+} orthogonal to ligand orbitals. The result shows that Kleiner's value of Dq with a wrong sign is corrected. This improvement is due to the large resonance energy between the 3d orbitals of the central ion and the ligand orbitals, which appears only in the molecular treatment. However, the model Cr^{3+}-$6H_2O$ cannot explain the observed change in the values of the spin–orbit coupling constant λ and the B-value. A possibl way to get over this difficulty is considered. A

535.343 : 539.132

8669. ABSORPTION SPECTRA OF UNSYMMETRICAL CYANINES. G.Araki and S.Huzinaga.
Progr. theor. Phys., Vol. 15, No. 4, 307-21 (April, 1956).

The absorption maximum of an unsymmetrical cyanine wit two different end nuclei is generally of a shorter wavelength than a mean value of absorption maxima of two symmetrical cyanines with the respective nuclei. Two different simple models are found for describing this fact. The first is a modification of the free-electron model which is based on an assumption that the influence of end nuclei on the π electrons in the conjugated chain can be represented by the Pöschl–Teller potential. The second is the Herzfeld–Sklar model which is based on the consideration of the interaction between various chemical states of cyanine ions. Both the models can fairly reproduce the observed fact. A.

535.343

8670. STRUCTURE OF THE INFRARED "ATMOSPHERIC" BANDS IN LIQUID OXYGEN. C.W.Cho, E.J.Allin and H.L.Welsh.
J. chem. Phys., Vol. 25, No. 2, 371-2 (Aug., 1956).

Absorption curves for 7800-11 000 cm^{-1} are given for pure liquid O_2 and for mixtures with N_2 and A. The bands are interpreted in terms of combinations of electronic and vibrational changes in a pair of adjacent molecules, the second of which may be O_2 or N_2. G.F.Lothian

535.343 : 539.132

8671. SPECTROSCOPIC STUDIES OF REACTIVE MOLECULES BY THE MATRIX ISOLATION METHOD. E.D.Becker and G.C.Pimentel.
J. chem. Phys., Vol. 25, No. 2, 224-8 (Aug., 1956).

The matrix isolation method for the study of reactive molecules is described. The properties that should be possessed by a material suitable for use as a matrix are discussed with

particular reference to spectroscopic investigations. Tests of the method have been conducted with infrared spectroscopic techniques using the free radical NO_2 and the hydrogen bonding molecules HBr, HCN, HN_3, NH_3 and H_2O. Xenon, nitrogen and argon are effective as matrices in isolating these molecules at 20° K with a mole ratio of matrix to active material in the range 100 : 1 to 500 : 1. The vibrational frequencies of these molecules isolated in a matrix are nearly the same as the frequencies in the gas phase. A.

535.343

8672. ON THE PRESUMED SPECTROSCOPIC EVIDENCE FOR TRAPPED HO_2 RADICALS. P.A.Giguère and K.B.Harvey.
J. chem. Phys., Vol. 25, No. 2, 373 (Aug., 1956).

Infrared bands of condensed products from dissociated water vapour, previously attributed (Giguère, Abstr. 2978/1955) to HO_2 radicals are now shown to arise from impurities. G.F.Lothian

535.343 : 539.132

8673. INFRARED SPECTRUM OF MERCURIC CHLORIDE AND BROMIDE. W.Klemperer and L.Lindeman.
J. chem. Phys., Vol. 25, No. 3, 397-9 (Sept., 1956).

The frequency of the antisymmetric stretching motion in gaseous $HgCl_2$ and $HgBr_2$ has been measured. The bond—bond interaction force constant in these molecules is small. A.

535.343

8674. INFRARED INTENSITIES IN LIQUIDS. J.H.Jaffe and S.Kimel.
J. chem. Phys., Vol. 25, No. 2, 374-5 (Aug., 1956).

The Lorentz expression for the total intensity of an absorption band as a function of the refractive index of the surrounding medium is confirmed for measurements of the band near 3 μ of hexane dissolved in fluorolube, CCl_4 and CS_2. The wavelength shifts found are accounted for by Kirkwood's theory. G.F.Lothian

535.343

8675. WIDTHS OF INFRARED ABSORPTION BANDS IN LIQUIDS AND SOLIDS. J.U.White and J.N.Howard.
J. Opt. Soc. Amer., Vol. 46, No. 8, 662 (Aug., 1956).

High-resolution measurements on some 15 specimens show that the band width at 90% of maximum height varies between 1 and 5 cm^{-1}. To measure absorption coefficients obeying Beer's law at the peaks, the slit-width would have to be in some cases $\frac{1}{2}$ cm^{-1} or less. G.F.Lothian

535.343

8676. INFRARED SPECTRUM OF SOLID SULFUR DIOXIDE. R.N.Wiener and E.R.Nixon.
J. chem. Phys., Vol. 25, No. 1, 175 (July, 1956).

The bands found in a film at 95° K in the range 520-2480 cm^{-1} are interpreted in terms of the vibrational frequencies of the free molecule and calculated low-frequency torsional oscillations about the C_2 axis. G.F.Lothian

535.343

8677. POLARIZED INFRARED SPECTRUM OF $KAg(CN)_2$. L.H.Jones.
J. chem. Phys., Vol. 25, No. 2, 379-80 (Aug., 1956).

Measurements show that as in $KAu(CN)_2$ (Abstr. 8159/1954) the linear group NCAgCN is inclined at about 28° to the C axis of the crystal. G.F.Lothian

535.343 : 539.132

8678. ANISOTROPY OF THE ABSORPTION OF GYPSUM CRYSTALS IN THE INFRARED REGION. G.A.Zaĭtsev and B.C.Neporent.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 857-63 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 733-8 (July, 1956).

A microscopic adapter and a polarizer were built for the infrared spectrometer, and the anisotropy of absorption and reflection of the gypsum crystals in the region 2-11μ investigated. For a series of spectrum bands corresponding to the vibrations of the molecules of water and SO_4^{--} groups, pleochroism and splitting into variously polarized components were observed. The origins of some bands were determined and conclusions were drawn about the character of coupling of vibrations in the lattice. A.

535.343 : 535.333

8679. FIRST SINGLET—SINGLET ELECTRONIC TRANSITION IN THE PHENANTHRENE MOLECULE AND THE BAND STRUCTURE OF THE PHENANTHRENE CRYSTAL. D.S.McClure.
J. chem. Phys., Vol. 25, No. 3, 481-5 (Sept., 1956).

The absorption and emission spectra of single crystals of phenanthrene have been studied at 20° K. The data show that the transition moment in the molecule is short-axis polarized, and that the factor group splitting in the crystal is 47 cm^{-1}. The emission originates in a region of very weak absorption at a frequency below the main absorption in analogy to several other molecular crystals whose spectra have been studied. It is suggested that the emitting level corresponds to a distorted lattice site. A.

535.343

8680. INFRARED SPECTRA OF HIGH POLYMERS. I. EXPERIMENTAL METHODS AND GENERAL THEORY. C.Y.Liang, S.Krimm and G.B.B.M.Sutherland.
J. chem. Phys., Vol. 25, No. 3, 543-8 (Sept., 1956).

The problems involved in obtaining and interpreting the infrared spectra of high polymers are discussed. Experimental methods are described for recording the infrared spectrum, with particular emphasis on the techniques used in the region between 30 and 140 μ. The method for obtaining selection rules for high polymer spectra is described and the use of selection rules and other techniques for assigning fundamental frequencies is evaluated. The calculation of the skeletal frequencies of a polymer molecule is discussed in detail. A.

535.343

8681. INFRARED SPECTRA OF HIGH POLYMERS. II. POLYETHYLENE. S.Krimm, C.Y.Liang and G.B.B.M.Sutherland.
J. chem. Phys., Vol. 25, No. 3, 549-62 (Sept., 1956).

The infrared spectrum of polyethylene has been obtained between about 3000 cm^{-1} and 70 cm^{-1}, polarization measurements on oriented specimens having been obtained to about 350 cm^{-1}. Assignments of the fundamentals are made with the help of a group theory analysis. The assignment of the controversial CH_2 wagging mode is discussed in detail and especially in terms of new evidence from the spectra of n-paraffins, both as single crystals and as polycrystalline aggregates. It is shown that this mode is to be assigned to a weak band at 1369 cm^{-1}. A satisfactory determination of the bands which arise from CH_3 groups is also made possible by a study of the paraffin spectra. The splitting of bands in the spectrum is conclusively shown to arise from interactions between molecules in the crystalline phase. The nature of this interaction is discussed in terms of recent theories. A.

535.343

8682. INFRARED SPECTRA OF HIGH POLYMERS. III. POLYTETRAFLUOROETHYLENE AND POLYCHLOROTRIFLUOROETHYLENE. C.Y.Liang and S.Krimm.
J. chem. Phys., Vol. 25, No. 3, 563-71 (Sept., 1956).

The infrared spectra of polytetrafluoroethylene and polychlorotrifluoroethylene have been obtained between 4000 cm^{-1} and 70 cm^{-1}. Polarization measurements on oriented samples were obtained in the region of 4000 cm^{-1} to 300 cm^{-1}. It is known from X-ray diffraction studies that both polymers have helical chain configurations. From a factor group analysis of the one-dimensional space group, selection rules and approximate vibra-

tional patterns of the infrared active fundamentals have been derived. A calculation of the normal frequencies of an assumed planar zig-zag chain model of $(CF_2)_n$ has been made, resulting in a satisfactory assignment of the bands in the infrared spectra of both polymers. A.

535.343 : 535.375.5

8683. VIBRATION SPECTRA OF DIPHENYL AND DECADEUTERODIPHENYL. G.S.Landsberg, A.L.Shatenshteĭn, G.V.Peregudov, E.A.Izrailevich and L.A.Novikova.
Optika i Spektrosk., Vol. 1, No. 1, 34-40 (1956). In Russian.

Half the paper deals with the preparation of the substances studied. A method has been developed of obtaining decadeuterodiphenyl by means of an isotope exchange reaction between diphenyl and deuteroammonia in the presence of potassium amide. The rest of the paper gives the results of an investigation of the Raman scattering and infrared absorption spectra of the substances. C.R.S.Manders

535.343 : 537.228.1

8684. RADIO FREQUENCY ABSORPTION IN BARIUM CHLORATE. S.Kojima, K.Kato and S.Annaka.
J. Phys. Soc. Japan, Vol. 11, No. 7, 805-6 (July, 1956).

A crystal of $Ba(ClO_3)_2.H_2O$ showed Cl^{35} quadrupole resonance at 29.38 Mc/s, but after heating to 150°C for several hours the quadrupole signal had disappeared to be replaced by a piezoelectric-like absorption. The crystal is monoclinic with space group C_{2h}^5 and should not be piezoelectric unless strains develop in the heat treatment. Debye–Scherrer X-ray pictures were the same before and after heat treatment. D.H.Whiffen

535.343 : 537.311.33

INFRA-RED ABSORPTION IN SEMICONDUCTORS. See Abstr. 8771

535.343 : 539.132

INFRARED SPECTRUM OF MONOMERIC FORMIC ACID. See Abstr. 8896

535.343 : 539.132

LOW-FREQUENCY LIBRATIONS AND THE VIBRATIONAL SPECTRA OF MOLECULAR CRYSTAL. See Abstr. 8897

535.37 : 537.312.5

PHOTOCONDUCTIVITY AND LUMINESCENCE OF POLYCRYSTALLINE CdS(Cu). See Abstr. 8801

535.37 : 537.312.5

PHOTOCONDUCTIVITY, LUMINESCENCE AND LIGHT ABSORPTION IN HgI_2 CRYSTALS. See Abstr. 8804

535.37 : 537.533.2 : 548.7

8685. THE INFLUENCE OF ADDITIVES ON THE COLORATION, ELECTRON EMISSION AND LUMINESCENCE OF X-RAY IRRADIATED IONIC CRYSTALS. A.Bohun.
Czech. J. Phys., Vol. 6, 141-51 (April, 1956). In German.

Studies are made of the effect of impurities such as Ag, Ca and Pb on the formation of colour centres by X-rays and the effect on electron emission and luminescence for crystals of rock salt. In the case of fluorite it is shown that the green coloration and resulting luminescence cannot be completely explained by the presence of rare earths. Previous theories and methods for determination of thermal dissociation energies of colour centres and of the "frequency factors" are discussed in the light of the above studies. G.F.J.Garlick

535.37

8686. INVESTIGATION OF THE ORIGIN OF LEVELS OF ELECTRON LOCALIZATION IN ZINC SULPHIDE PHOSPHORS. N.V.Zhukova.
Zh. éksper. teor. Fiz., Vol. 29, No. 5(11), 680-92 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 608-19 (July, 1956).

The role of copper and oxygen in the formation of three bands of localization levels of electrons in Zns(Cu) phosphor is clarified by the method of temperature controlled luminescence. The action of iron, nickel and cobalt on the separate maxima of the temperature controlled luminescence curve is examined. It is found that Fe and Ni in small concentrations may sharply increase the intensity of luminescence. A.

535.37

8687. ON THE LOWERING OF THE LUMINESCENCE YIELD OF PHOSPHORS WITH INTENSE EXCITATION. V.V.Antonov-Romanovskiĭ and L.A.Vinokurov.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 830-3 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 711-13 (July, 1956).

It is shown that the lowering of the luminescent output of ZnS(Cu) and ZnS(Cu, Co) phosphors with intense excitation is conditioned to a considerable degree by the illuminating action of the exciting light and by the fact that the recombination of optical electrons or "holes" results in radiationless transitions. The same causes result in the fact that the total illumination, determined from the curve of increasing illumination, turns out to be considerably smaller than the total illumination determined from the curve of the extinction process. A.

535.37

8688. SOME PROBLEMS IN RECOMBINATION LUMINESCENCE ASSOCIATED WITH VARIOUS FORMS OF EXCITATION IN KCl(Tl) PHOSPHORS. I.P.Shchukin.
Zh. éksper. teor. Fiz., No. 6(12), 834-46 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 714-24 (July, 1956).

The efficiency of activator-produced electron–radiation recombination has been measured in KCl(Tl) phosphors using excitation by ultraviolet light, X-rays and γ-rays. An estimate is made of the quenching probability at the Tl^+ ion luminescence centre. The existence of a transfer of excitation energy from the host material to the activator is confirmed. The predominating process is found to be the transfer of phosphorescence excitation energy associated with Tl^+ ionization. A decrease in the activator absorption is found on excitation of the phosphor; this is connected with the Tl^+ ionization. A.

535.37 : 548.5

PREPARATION OF ALKALI HALIDE PHOSPHORS. See Abstr. 9027

535.371

8689. POLARIZATION OF LUMINESCENCE AND THE CHARACTER OF THE ABSORPTION AND EMISSION PROCESSES. I.Ketskeméty and L.Szalay.
Acta phys. Hungar., Vol. 5, No. 3, 305-11 (1955). In German.

The relations between polarization of absorbed and emitted radiation and the nature of oscillators involved developed by Wavilov (Zh. éksper. teor. Fiz., Vol. 10, 1363, 1940) are generalized for non-parallel or orthogonal cases for the angle between absorption and emission oscillators. The theory is compared with results for the polarization of fluorescence in fluorescein, aesculin, rhodulin orange and trypaflavin in solution. G.F.J.Garlick

535.371

8690. TRANSFER OF ELECTRONIC ENERGY. QUENCHING OF FLUORESCENCE BY OXYGEN AND NITRIC OXIDE. J.T.Dubois.
J. chem. Phys., Vol. 25, No. 1, 178 (July, 1955).

Nitric oxide is found to be just as effective as oxygen in quenching the fluorescence of β-naphthylamine, giving an equivalent quenching cross-section and quenching efficiency of unity. Resonance transfer is considered unlikely in the

ystems considered with the above but the conditions defined y Karyakin are satisfied (Karyakin, Terenin and Kalenichenko, okl. Akad. Nauk SSSR, Vol. 67, 305, 1949). G.F.J.Garlick

535.371

691. SENSITIZATION OF THE LUMINESCENCE OF MANANESE INCORPORATED IN ZINC SULFIDE PHOSPHORS. .Shionoya and K.Amano.
. chem. Phys., Vol. 25, No. 2, 380-1 (Aug., 1956).

The effect of additions of Pb, Ag or Bi on the luminescence f ZnS.Mn phosphors. From the response to varying excitation avelength (Abstr. 7857/1955) Pb acted as a sensitizer, Ag and i did not. This is advanced as evidence for a resonance transer mechanism of sensitization. C.H.L.Goodman

535.371

692. THE LUMINESCENCE OF URANIUM-ACTIVATED ODIUM FLUORIDE. W.A.Runciman.
roc. Roy. Soc. A, Vol. 237, No. 1208, 39-47 (1956).

The fluorescence and absorption spectra of various ranium-activated sodium fluoride phosphors have been studied t liquid-nitrogen and liquid-helium temperatures. These esults are interpreted in terms of a model in which the ranium ion is surrounded octahedrally by six oxygen ions. xperiments with O^{18} have provided support for this atomic onfiguration, several lines in the fluorescence spectrum aving an isotope shift. These isotope shifts are in agreement ith the predictions of a general theory of the vibrational fine tructure in luminescence spectra. A.

535.371

693. ON THE INFRARED-RESPONSIVE BEHAVIORS OF ZINC : CADMIUM–SULPHIDE : SELENIDE)-TYPE PHOSPHOR AMILIES. III. ZINC–SULPHIDE : SELENIDE PHOSPHORS 2). S.Asano.
ci. of Light (Tokyo), Vol. 4, No. 1, 16-31 (Aug., 1955).

For Pt II, see Abstr. 10067 (1954). Some singly or doubly ctivated cubic or hexagonal zinc sulphide: selenide phosphors ave been prepared. Their spectral infrared-responsivity and pectral distrubution of luminescence as well as their crystal tructure are investigated. The results obtained are compared ith those on other zinc sulphide : selenide phosphors, which re reported in the previous paper. Further, they are exlained qualitatively by a model, which contains two types of lectron traps, namely traps associated with emission centres nd isolated traps. A.

535.371

694. ON THE INFRARED-RESPONSIVE BEHAVIORS OF ZINC : CADMIUM–SULPHIDE : SELENIDE)-TYPE PHOSPHOR AMILIES. IV. ZINC : CADMIUM–SULPHIDE PHOSPHORS. .Asano.
ci. of Light (Tokyo), Vol. 4, No. 1, 32-47 (Aug., 1955).

Some (Zn : Cd) S phosphor families activated with Pb, Mn, u, Bi or Ag have been prepared at two different crystallizaion temperatures, and their spectral infrared responsivities nd decay characteristics in natural and infrared-stimulated or uenched phosphorescences are investigated under the same iven conditions. The results are compared with those of the orresponding Zn(S : Se) phosphor families. The comparison hows that the influences of CdS and ZnSe upon the infraredesponsive behaviour of ZnS-type phosphors are substantially imilar and that the model proposed in the previous paper is vailable also for the infrared-responsive (Zn : Cd)S phosphors. A.

535.371

695. ON THE INFRARED-RESPONSIVE BEHAVIORS OF ZINC : CADMIUM-SULPHIDE : SELENIDE)-TYPE PHOSPHOR AMILIES. V. ZINC : CADMIUM-SULPHIDE : SELENIDE HOSPHORS. S.Asano.
ci. of Light (Tokyo), Vol. 4, No. 1, 48-60 (Aug., 1955).

Some (Zn : Cd)(S : Se) phosphors activated with Pb, Mn, u, and Ag have been prepared. Their spectral infraredresponsivity and the decay of their natural and infrared-simulated or -quenched phosphorescence as well as their luminescence and crystal structure are investigated. The results obtained show that the infrared-responsive behaviour of the (Zn : Cd) (S : Se) phosphors are qualitatively similar to those of the Zn(S : Se) and (Zn : Cd)S phosphors, which are reported in the previous parts, and that the infrared-responsive mechanism of ZnS phosphors are not substantially altered by the addition of CdSe. A.

535.371

8696. ON THE INFRARED-RESPONSIVE BEHAVIORS OF (ZINC : CADMIUM–SULPHIDE : SELENIDE)-TYPE PHOSPHOR FAMILIES. VI. GENERAL SURVEY AND SUMMARY. S.Asano.
Sci. of Light (Tokyo), Vol. 4, No. 2, 163-85 (Nov., 1955).

General features of i.r.-responsive behaviour of these ZnS-type phosphors are compared with one another and summarized. Further, the type of model which is most suited for the explanation of their behaviour is discussed. Quantitative conclusions based on the most suitable model, which contains shallow traps and deep traps, are compared with the experimental results reported in the preceding Parts. The comparison shows satisfactory agreement between them. A.

535.371 : 551.521.3

LABORATORY EXPERIMENTS WITH DAY AIRGLOW.
See Abstr. 9106

535.372

8697. FLUORESCENT SPECTRA OF SOME ORGANIC CRYSTALS. J.B.Birks and A.J.W.Cameron.
S.African J. Sci., Vol. 53, No. 1, 16-19 (1956).

Observations have been made of the microcrystalline fluorescence spectra of anthracene, 1 : 2 benzanthracene and eleven of its twelve mono-methyl derivatives. The spectra were excited by 253.7 mμ radiation and the relative quantum intensities observed with a calibrated spectrophotometer and photomultiplier. Analysis of the results shows spectral shifts due to environment and to methyl substitution. An unusual effect in the 5-methyl and 8-methyl compounds is reported. A.

535.372

8698. CATHODO-LUMINESCENCE SPECTRA OF ALKALI HALIDES. B.D.Saksena and L.M.Pant.
Z. Phys., Vol. 146, No. 2, 205-16 (1956).

Cathodo-luminescence spectra of fourteen alkali halides and of some mixed crystals of NaCl and KCl have been studied. The spectra show broad structureless bands. In some ten halides it is possible to find a strong band whose peak position shifts towards longer wavelengths as the interatomic distance increases. For potassium halides the relationship $\lambda max = 1380d$, where "d" is the inter-atomic distance, holds approximately but is not generally true. A mechanism of cathodo-luminescence in alkali halides has been postulated, and an interpretation of the above band and of some NaCl bands has been made on that basis. A.

535.375.5

8699. METHODS OF INVESTIGATING THE WIDTH OF RAMAN LINES AND THEIR APPLICATION. P.A.Bazhulin, S.G.Rautian, A.I.Sokolovskaya and M.M.Sushchinskii.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 822-9 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 663-9 (July, 1956).

The effect of various factors on the observed width of Raman lines was considered, and methods of excluding the effect of these factors on the results of measurements are described. Results are given of measurements of the width of a number of Raman lines for 5 hydrocarbons using a prism spectrograph with large dispersion. A comparison is made of the data obtained with data found by other methods. A.

PA

535.375.56

8700. RAMAN SPECTRUM OF UF_6. H.H.Claassen, B.Weinstock and J.G.Malm.
J. chem. Phys., Vol. 25, No. 3, 426-7 (Sept., 1956).

Two of the 3 Raman-active fundamentals of UF_6 have been observed at 666.6 ± 0.3 (ν_1) and 535 ± 5 cm^{-1} (ν_2) for a gaseous sample. The new value for ν_2 is in good agreement with the value 532 cm^{-1} obtained earlier by Gaunt from infrared combinations. The sample of UF_6 was contained in a Pyrex Raman tube and was irradiated for many hours with no visible deterioration. Gaunt's thermodynamic functions remain valid. A.

535.379

8701. A THEORETICAL DISCUSSION OF THE CONDITIONS NECESSARY FOR CHEMILUMINESCENCE. J.C.Polanyi.
Airglow and the aurorae (Belfast) 346-50. See Abstr. 7088 (1956).

The conditions necessary for chemiluminescence are discussed for an atomic reaction $A + BC \rightarrow AB + C$. A method is outlined by which it should be possible to calculate the expected light-yield for a reaction of this type. The method consists in the calculation of the total probability that the reaction will take place with BC extended to $\geq r^*_{BC}$ a critical separation corresponding to a repulsive energy between AB and $C \leq (|\Delta H| - N_0 h\nu)$, where ν is the minimum frequency of the emitted light and ΔH is the heat of reaction. A preliminary calculation indicates that the method will predict absolute light-yields in satisfactory agreement with the observed values for the reactions $Na + X\,Hg \rightarrow NaX + Hg$ (X = Cl, Br, I). A.

535.379 : 551.521.3

ON THE CHEMILUMINESCENCE OF THE SODIUM D LINES IN THE REACTION BETWEEN OZONE AND SODIUM VAPOUR. See Abstr. 9105

535.39 : 525.22

8702. LUMINOUS REFLECTANCE (VISUAL ALBEDO) OF NATURAL OBJECTS. R.Penndorf.
Bull. Amer. Meteorol. Soc., Vol. 37, No. 4, 142-4 (April, 1956).

The spectral reflectance of natural objects is taken from Krinov's measurements. Based on these data, the luminous reflectance (visual albedo) is computed for natural objects. The results obtained are compared with other published data. The wealth of data can now be grouped into four classes and twenty-four main types. The luminous reflectance of most natural objects (except snow and a few formations) remains below 15 percent. A.

535.39 : 539.234

8703. TRANSMISSIVITY OF THIN CARBON FILMS. R.J.Thorn and G.H.Winslow.
J. chem. Phys., Vol. 23, No. 9, 1729-30 (Sept., 1955).

The growth of optical density was measured during evaporation at two temperatures; the non-linear shape of the curves was in accord with optical theory, except at the beginning and end; reasons for this are discussed. Values of $n = 2.39$, $k = 1.05$ at 661 $m\mu$ were obtained. The method is considered reliable for measuring relative thicknesses of carbon films.

535.39

8704. WIDTH OF INFRARED REFLECTION BANDS. C.Haas and J.A.A.Ketelaar.
Phys. Rev., Vol. 103, No. 3, 564 (Aug. 1, 1956).

The width of strong reflection bands is determined by the oscillator strength, while the width of absorption bands is determined by the damping. The width of the reflection bands of the alkali halides, calculated from the dielectric constant and the normal index of refraction, is in agreement with the experimental data. A.

535.417 : 535.822 : 537.311.33

8705. THE USE OF AN INTERFERENCE MICROSCOPE FOR MEASUREMENT OF EXTREMELY THIN SURFACE LAYERS. W.L.Bond and F.M.Smits.
Bell Syst. tech. J., Vol. 35, No. 5, 1209-21 (Sept., 1956).

A method is given for the thickness measurement of p-type or n-type surface layers on semiconductors. This method requires the use of samples with optically flat and reflecting surfaces. The surface is lapped at a small angle in order to expose the p-n junction. After detecting and marking the p-n junction, the thickness is measured by an interference microscope. Another application of the equipment is the measurement of steps in a surface. The thickness range measurable is from 5×10^{-6} cm to 10^{-3} cm. A.

535.417

8706. REMARKS ON THE FUNCTIONING AND STANDARDIZATION OF BIREFRINGENT ARRANGEMENTS FOR THE STUDY OF A TRANSPARENT FILM BY INTERFEROMETRY WITH POLARIZED LIGHT. G.Gontier and A.Martinot-Lagarde.
C.R. Acad. Sci. (Paris), Vol. 242, No. 26, 3054-6 (June 25, 1956). In French.

The usual wave-front treatment is replaced by a ray tracing method. A procedure is given for measuring variations in optical thickness, a procedure particularly applicable to aerodynamics. S.Tolansky

535.417

8707. LINEAR GAS MASS FLOW DEVICE WITH APPLICATIONS TO INTERFEROMETRY. D.H.Rank and J.N.Shearer.
J. Opt. Soc. Amer., Vol. 46, No. 6, 463-4 (June, 1956).

Some Fabry–Perot interferometer systems employ gas pressure variation to move the fringe system slowly. A nearly linear mass flow system for this purpose is described. A jet nozzle is used of dia. 0.1 mm, gas pressure being 2.4 atm. There is effective linear mass flow over a pressure range 5 to 70 cm Hg in the interferometer. Non-linearity is some 0.5%. S.Tolansky

535.417 : 531.717

8708. MEASUREMENT OF THE THICKNESS OF THIN FILM BY MULTIPLE-BEAM INTERFERENCE. C.Weaver and P.Benjamin.
Nature (London), Vol. 177, 1030-1 (June 2, 1956).

Experiments have been carried out on the measurement of the thickness of thin silver films, using both silver and chromium as the overlayer material. A standard experimental procedure was adopted for the deposition of these films, which were evaporated on to selected glass microscope slides. The thicknesses of the silver films were measured by multiple-beam interference fringes of equal thickness viewed in reflection. The results indicate that when the chromium overlayer is opaque, then there is no discrepancy in the thickness of the silver film as measured by the two different overlayers. However, when the chromium overlayer is not opaque, then a discrepancy of the type found by Avery occurs. The discrepancy in the thickness measurements when a non-opaque chromium layer is used may be caused by a difference in the phase change at reflection on the two sides of the step-edge since the underlying substances are different. S.Tolansky

535.417

8709. A FABRY–PEROT ETALON FOR THE STUDY OF THE GREEN LINE OF THE NIGHT-SKY LIGHT. R.V.Karandikar.
Rev. Opt., Vol. 35, No. 7, 414-20 (July, 1956).

Description of the optical details and the performance of a Fabry-Perot etalon of large aperture and high order designed for the photoelectric measurements of the Doppler width of the 5577 A line in the night air glow. A.

535.42 : 538.566.3 : 551.510.535

8710. SOME ASPECTS OF DIFFRACTION THEORY AND THEIR APPLICATION TO THE IONOSPHERE. J.A.Ratcliffe.

ep. Progr. Phys., Vol. 19, 188-266 (1956).

In Part I the "Fourier" approach to diffraction theory is utlined in such a way as to emphasize its physical signific- nce. Particular attention is paid to diffraction phenomena of ne Fresnel type, and to diffraction from screens which alter oth the phase and the amplitude of the incident wave. The Fourier" approach is extended to deal with problems of random" diffraction, for which purpose the use of auto- orrelation functions is introduced and explained in physical erms.

In Part II measurements made on radio waves reflected rom, or transmitted through, the ionosphere are discussed. he nature of the radio diffraction pattern observed at the round is first summarized and deductions are then made about ne ionosphere which has given rise to this diffraction. There re few references in the text, but the bibliography provides rief abstracts of the more important papers on the subject. A.

535.43

8711. CORRELATION OF INTENSITIES IN THE FINE-STRUCTURE COMPONENTS OF THE RAYLEIGH-SCATTERING LINE. I.L.Fabelinskiĭ

Dokl. Akad. Nauk SSSR, Vol. 106, No. 5, 822-5 (1956). In Russian.

Venkateswaran and Bai (Proc. Indian Acad. Sci. A, Vol. 15, 316-21, 349-56, May, 1942) conclude that the formula $I_C/(2\,I_{M-B}) = \gamma - 1$ (where I_C = the integral intensity of the central component, $2\,I_{M-B}$ = the integral intensity of the side components and $\gamma = c_p/c_v$) does not agree with experiment, whereas, according to Birus (Physikalische Zeitschrift, Vol. 39, 80, 1938) and Rank et al. (Abstr. 1825/1948) it does agree with experiment. The author derives a more general (but still approximate) expression in which the right-hand side of the above formula is replaced by

$$\left[\left(\frac{1}{\alpha}\frac{\partial\epsilon}{\partial T}\right)_p^2 \Big/ \left(\rho\frac{\partial\epsilon}{\partial\rho}\right)_s^2\right] \alpha^2 T/c_p\rho\beta_S,$$

where $\epsilon = n^2$ (n being the refractive index), ρ = density, α = coefficient of thermal expansion, c_p = specific heat at constant pressure, β_S = adiabatic compressibility and T = absolute temperature. In order to obtain better experimental data the author developed a method enabling the photographs of fine structure details to be taken simultaneously in two mutually perpendicular directions of polarization, thus making it possible to eliminate the arbitrary nature of the "background line". The results of measurements agree with the values calculated from the more general formula, whereas they always exceed those calculated from the simple formula. F.Lachman

535.43 : 536.424.1

8712. THE OPALESCENCE PHENOMENON ASSOCIATED WITH PHASE TRANSFORMATION IN QUARTZ. I.A.Yakovlev, L.S.Velichkina and L.F.Mikheeva.

Dokl. Akad. Nauk SSSR, Vol. 107, No. 5, 675-7 (1956). In Russian.

Experiments were conducted to establish the temperature dependence of the molecular scattering of light in quartz in the range 15-600° C. The $\alpha \rightleftharpoons \beta$ transformation of quartz is likely to be a λ point. An intense beam of light from a Hg lamp passed along one of the axes of a quartz crystal arranged in a furnace. The light scattered at right angles fell on a photoelectronic multiplier. Above 500° C a sudden and sharp maximum of $I_T/I_{20°}$ was observed, corresponding with a phase transition in a solid. When one of the crystal ends attained the phase-transition temperature, an optically heterogeneous zone characterized by an intense scattering capacity appeared at that end. This cloud-like zone moved towards the other end as the furnace temperature rose, the outlines of the zone coinciding with isothermic sections of the crystal in the furnace. The linear thickness of the cloudy zone corresponded with a temperature interval of ~ 0.1° C. The cloudy zone scattered white light ~ 1.4×10^4 times more strongly than quartz at room temperature. F.Lachman

535.43

8713. REPRESENTATION OF THE ANGULAR DISTRIBUTION OF RADIATION SCATTERED BY A SPHERICAL PARTICLE. C.-M.Chu and S.W.Churchill.

J. Opt. Soc. Amer., Vol. 45, No. 11, 958-62 (Nov., 1955).

Exact expressions have been derived from the Mie equations for the angular distribution coefficients, a_n, in an equation proposed by Hartel in 1940 for the fraction of randomly polarized radiation scattered by a spherical particle into a unit solid angle in the direction θ. The coefficients are functions of the wavelength, particle diameter, and physical properties. This equation is shown to be more convenient in form for tabulation of the scattering properties and for application than the intensity functions used by Mie and most subsequent investigators. Approximate methods for evaluating the coefficients were found to be inaccurate or inconvenient. The exact expressions, although detailed, are suitable for straightforward computation. A.

535.434 : 535.324

8714. EFFECT OF LIGHT SCATTERING UPON THE REFRACTIVE INDEX OF DISPERSED COLLOIDAL SPHERES. M.Nakagaki and W.Heller.

J. appl. Phys., Vol. 27, No. 9, 975-9 (Sept., 1956).

The Zimm–Dandliker equation on the effect of light scattering upon the refractive index of colloidal dispersions of spheres is found to be in good agreement with experimental facts. It is transformed to give a new mixture rule from which the refractive index of colloidal spheres, to be expected in absence of light scattering, can be calculated. The latter is needed for particle size determinations in colloidal solutions from light-scattering measurements to be evaluated on the basis of the Mie theory. For the same purpose, a graphical method is worked out which is less time consuming and yields very accurate results. The graphical method allows one to obtain simultaneously both the refractive index and the diameter of the particles. The method is tested successfully against data obtained by alternate procedures used heretofore. A.

535.434 : 578.08

8715. A PRIORI CALCULATION OF THE NUMBER OF BACTERIA IN A TURBID SUSPENSION. D.H.Taysum.

J. chem. Phys., Vol. 25, No. 1, 183-4 (July, 1956).

Since the turbidity varies inversely as the fourth power of the wavelength (λ) it is assumed that scattering from bacteria occurs at independent centres on the surface which are much smaller than λ. Insertion of reasonable values of refractive index into the Rayleigh equation gives values for the number in agreement with counts. G.F.Lothian

535.55

8716. BIREFRINGENCE CHANGES DURING RETRACTION OF ORIENTED POLYSTYRENE MONOFILAMENTS. I. CHANGES OF AVERAGE BIREFRINGENCE. R.D.Andrews and J.F.Rudd.

J. appl. Phys., Vol. 27, No. 9, 990-5 (Sept., 1956).

The changes in average birefringence during retraction have been measured at 85° C for four different oriented polystyrene monofilaments. The relationship between birefringence decay and length decrease is not linear: the birefringence decay is relatively more rapid than the length decrease, in all cases. Also, the birefringence–length relationship seems to be essentially independent of retraction temperature. Birefringence decay rate can be reduced by a factor of 1000 by not allowing the filament to retract. One of the filaments shows an interesting change in sign of the birefringence, from negative to positive, in the final stages of the retraction. The birefringence decay data for the four filaments could not be reduced to any universal curve by plotting either birefringence or relative birefringence against any simple functions of length or extension (all the filaments were made from the same polymer,

so that a reduction to some such common basis should be possible). Analysing the data in terms of a distribution of retardation times, by assuming that birefringence decay and length decrease are in some constant ratio for each retardation time (where the additional parameter, time, is introduced), also failed to reduce the data to a single common curve. Internal stress may be an essential parameter for a proper characterization of the birefringence. A.

535.55

8717. BIREFRINGENCE CHANGES DURING RETRACTION OF ORIENTED POLYSTYRENE MONOFILAMENTS. II. CHANGES IN RADIAL DISTRIBUTION OF BIREFRINGENCE. J.F.Rudd and R.D.Andrews.
J. appl. Phys., Vol. 27, No. 9, 996-1002 (Sept., 1956).

The radial distribution of birefringence, $\Delta(r)$ has been measured at a series of time values up to 600 hr, during retraction at 85° C. The birefringence distribution was obtained by cutting wedges on the end of the filament samples and analysing the optical interference pattern down the centre line of the wedges, under a polarizing microscope. The rates of birefringence decay at different points along the radius are not the same, or even proportional; the interrelationship is apparently fairly complex. Birefringence values near the centre of the filament change from negative to positive sign in the long-time region, while values near the exterior surface remain negative throughout. Values of the diameter average birefringence calculated from $\Delta(r)$ are in close agreement with values obtained from direct experimental measurement. A cross-sectional-area average birefringence was also calculated from $\Delta(r)$; this quantity decreases monotonically toward zero, with no transition to positive values in the long-time region, and therefore corresponds more closely than the diameter average birefringence with the observed length changes. The area average is nearly proportional to the diameter average, however, except for values near zero. A.

535.55

8718. THE PASSAGE OF POLARIZED LIGHT THROUGH A MEDIUM WITH STATIONARY ULTRASONIC WAVES. A.M.Bonch-Bruevich.
Zh. tekh. Fiz., Vol. 26, No. 2, 442-4 (1956). In Russian.

Investigation of the possibility of employing the photoelastic effect for fast-acting optical shutters and for high-frequency modulation of light with the aid of stationary compression and rarefaction waves. An expression is derived for the periodic variation of light intensity produced by a stationary deformation wave in a transparent parallelepiped and for the optimum modulation pressure (which can be applied, e.g. by a piezoelectric or a magnetostriction device). A.Gelbtuch

535.557

8719. POLARIZATION FILTERS. O.Sziman.
Z.wiss. Photogr., Vol. 50 (II), No. 1-12, 517-49 (1955). In German.

After a brief introduction dealing with the production of linearly polarized light by reflection at dielectric surfaces and by polarizing prisms, a detailed and extensive review is given of polarization filters made from suspensions of small doubly refracting or dichroic crystals. The methods of production, the mechanism of their action, their practical and theoretical properties and their advantages and disadvantages are fully discussed. Over 60 references are given. H.G.Jerrard

535.557 : 532.77

FLOW BIREFRINGENCE AND STRESS. See Abstr. 8029

535.563

8720. OPTICAL ROTATORY DISPERSION OF HELICAL POLYMERS. W.Moffitt.
J. chem. Phys., Vol. 25, No. 3, 467-78 (Sept., 1956).

It is shown that for every transition in its individual residues, a helix has two transitions whose moments are respectively parallel and perpendicular to the screw axis. The largest contributions to the rotational strengths of these bands are equal and opposite in the two cases. As a result, their net effect on the optical activity contains a term proportional to the interval between the two upper states. This term shows abnormal dispersion and its magnitude and sign are more easily interpreted than any other component of the rotatory power. A.

535.7

PHYSIOLOGICAL OPTICS. VISION. See under "Medical science. Human physiology". Decimal classification 612.84.

535.822.9 : 621.385.832 : 621.389

8721. THE FLYING-SPOT MONOCHROMATIC ULTRAVIOLET TELEVISION MICROSCOPE. P.O'B.Montgomery, F.Roberts and W.Bonner.
Nature (London), Vol. 177, 1172 (June 23, 1956).

A flying-spot on a cathode-ray-tube screen excites ultraviolet radiation (2600A wavelength). The amount transmitted by a biological specimen, which is scanned by an image of the spot formed by a microscope, is recorded by a photomultiplier. The amplified signal from the latter modulates a synchronously operated display tube, the image on which is photographed. The signal-to-noise ratio is improved by using a 4 sec frame speed and 60 cycle line scan, and by exposing the photographic plate for several successive frames. The high quantum efficiency of the photocathode ensures a great reduction in the amount of ultraviolet radiation at the specimen necessary to produce an image, as compared with usual methods of microscopy. Photographs are shown of human cancer cells (Hela strain) with exposures of 1, 4 and 16 frames. V.E.Cosslett

535.825.2

8722. SEMI-AUTOMATIC RECORDER FOR FILAR MICROMETER EYEPIECE AND ITS APPLICATION TO TRACK MEASUREMENT. B.Stiller and F.I.Louckes, Jr.
Nuovo Cimento (Ser. 10), Vol. 4, No. 3, 642-47 (Sept., 1956).

A differential transformer has been mounted on a filar micrometer eyepiece and has been coupled to a recording circuit, to make possible automatic recording of the hairline positions. The apparatus greatly reduces the time required to make measurements with a filar eyepiece; e.g., as when measuring the multiple Coulomb scattering of tracks in nuclear emulsions. A.

535.89 : 541.14

SAPPHIRE LAMP FOR SHORT WAVELENGTH PHOTOCHEMISTRY. See Abstr. 9014

HEAT 536

536.21.01

8723. INFLUENCE OF THE INTEGRAL CRITERION OF FORM ON THE PROCESS OF HEAT CONDUCTION. A.G.Temkin.
Zh. tekh. Fiz., Vol. 25, No. 3, 497-511 (1955). In Russian.

The criterion of form of a body is defined as $S^{1/2}V^{-1/2}$ where S is the surface area, V the volume. There is a modification for a cylinder with an infinite dimension. The rate of cooling of certain bodies is expressed as a function of these criteria. The object of the work is to give a precise meaning to a general law of cooling which states that the rate of cooling of a given body increases with an increase of the ratio of the area of its surface to the volume of the body. Mathematical Reviews

536.21.01

724. A THEOREM ON THE MAXIMUM OF A TEMPERATURE GRADIENT. A.G.Temkin.
h. tekh. Fiz., Vol. 25, No. 3, 534-40 (1955). In Russian.

Continuation of the previous paper (see preceding abstract). is shown that if the surface of a body is increased without change in the volume of the body, then there takes place an ncrease of the rate of flow of heat from the body simultaneusly with a decrease in the specific heat flow through the urface of the body. Mathematical Reviews

536.212 : 621.317.39 : 621.317.729

725. THE STUDY OF THERMAL CONDUCTIVITY PROBEMS BY MEANS OF THE ELECTROLYTIC TANK. '.Reiniger.
Philips tech. Rev., Vol. 18, No. 2, 52-60 (1956-57).

The analogy between the electric field of a potential in an lectrolyte and the electrostatic field in a dielectric is menioned. A similar analogy exists between the potential field in n electrolyte and the temperature field in a conductor under onditions of steady heat flow. Methods of setting up an elecrical model (electrolytic tank) for a given thermal conductivity roblem are discussed and from this model the required informtion (temperature distribution in the conductor, thermal resisance) can be obtained. Account must be taken of possible discontinuities e.g. between a cooled metal wall and the cooling iquid. The method is applied to the study of the thermal beaviour of an oil-cooled copper X-ray anode carrying an embedded thin plate (pastille) of tungsten. The basis of the analogy of the model is explained by comparing the appropriate differenial equations. A.

536.23

8726. THERMAL CONDUCTIVITY OF He—A—Xe TERNARY MIXTURE. S.C.Saxena.
J. chem. Phys., Vol. 25, No. 2, 360-1 (Aug., 1956).

Experimental data are tabulated for the mixture at 38°C, obtained by the thick-wire variant of the hot-wire method. The conductivity calculated from the equation derived, and herein quoted, by Srivastava and Saxena agrees closely with the observed results. J.J.Phipps

536.241

8727. TRANSIENT THERMAL CONDUCTION BETWEEN TWO PLATES. F.Krupka.
Czech. J. Phys., Vol. 6, No. 1, 94-6 (Jan., 1956). In Russian.

A mathematical study of the flow of heat across two plates in thermal contact. The plates are assumed to be of different materials; one free surface is held at constant temperature, the other free surface is insulated. Solutions of the one-dimensional equation of thermal conduction, satisfying the appropriate boundary conditions, are obtained by Laplace transformation methods. R.Eisenschitz

536.253 : 541.126

8728. STUDY OF THE FORCED CONVECTION OF HEAT, ACCOMPANIED BY THE LIBERATION OF HEAT BY CHEMICAL REACTION IN THE BOUNDARY LAYER. G.Ribaud and P.Valentin.
C.R. Acad. Sci. (Paris), Vol. 243, No. 5, 463-6 (July 30, 1956). In French.

A platinum plate, heated electrically, is placed in an air current containing small percentages of hydrogen, with its plane parallel to the direction of the stream; the flow and hydrogen concentrations in the boundary layer were studied by means of a probe and by thermoelectric couples and the results are shown graphically for pure air and for air containing 2.9 and 4.7% of hydrogen. Two types of surface combustion were found to occur on the platinum plate, and are interpreted in terms of catalysis of hydrogen arriving at the platinum plate by a process of diffusion. J.S.G.Thomas

536.413 : 548.73

8729. THE THERMAL EXPANSION AND PHASE TRANSITIONS OF WO_3. C.Rosen, E.Banks and B.Post.
Acta cryst., Vol. 9, Pt 6, 475-6 (June, 1956).

The thermal expansion of WO_3 from room temperature to 700°C has been measured by X-ray diffraction methods. The expansion of the a and c axes of the unit cell can be represented by a smooth curve for the entire range investigated. The b axis expands uniformly from room temperature to about 300°C and decreases slightly in length from 330 to 700°C. The monoclinic unit cell undergoes a transformation near 330°C to an orthogonal form, which is probably orthorhombic. A.

536.413 : 548.73

8730. THE THERMAL EXPANSION OF CUBIC SODIUM TUNGSTEN BRONZES. C.Rosen, B.Post and E.Banks.
Acta cryst., Vol. 9, Pt 6, 477-8 (June, 1956).

The coefficients of thermal expansion of powdered cubic sodium tungsten bronzes (Na_xWO_3; $0.9 > x > 0.3$) from room temperature to 600°C have been determined. The expansion coefficients for all compositions studied are constant and essentially identical below transition temperatures (near 200°C) which vary with sodium content. At the transition temperatures, the expansion coefficients change sharply to lower values which vary with composition, going through a minimum near x = 0.5. The relation between these changes and a similar change in pure WO_3 is pointed out. A.

536.413 : 548.736.1

THERMAL EXPANSION OF THORIUM. See Abstr. 9047

536.422.1

8731. DISPROPORTIONATION AND VAPOR PRESSURE OF $TiCl_2$. M.Farber and A.J.Darnell.
J. chem. Phys., Vol. 25, No. 3, 526-30 (Sept., 1956).

The disproportionation and sublimation of $TiCl_2(s)$ have been investigated by means of a molybdenum effusion cell in a temperature range of 800 to 900°K. Heats and entropies of reaction at the average temperature of 850°K were obtained for three reactions:

(1) $2TiCl_2(s) = TiCl_4(g) + Ti$;
$\Delta H = 49.5 \pm 1$ kcal, $\Delta S = 32.2 \pm 1$ cal/°C.

(2) $3TiCl_2(s) = 2TiCl_3(g) + Ti$;
$\Delta H = 87.2 \pm 1$ kcal, $\Delta S = 62.1 \pm 1$ cal/°C.

(3) $TiCl_2(s) = TiCl_2(g)$;
$\Delta H = 46.8 \pm 1$ kcal/mole, $\Delta S = 30.7 \pm$ cal(°C.mole)$^{-1}$.

X-ray diffraction patterns of mixtures of $TiCl_2$ and $TiCl_3$ gave no evidence of any appreciable solid solution. A.

536.423.1 : 541.115

8732. MASS SPECTROMETRIC STUDY OF GASEOUS SPECIES IN THE B—B_2O_3 SYSTEM. M.G.Inghram, R.F.Porter and W.A.Chupka.
J. chem. Phys., Vol. 25, No. 3, 498-501 (Sept., 1956).

A combination of Knudsen effusion and mass spectrometric techniques have been employed in studying the species existing in the vapour in thermodynamic equilibrium with a condensed mixture of boron and boric oxide in the temperature range 1300°K to 1500°K. Positive ions were produced by electron bombardment of vapour effusing from the Knudsen cell and were analysed mass spectrometrically. Ion currents of B^+, BO^+, $B_2O_2^+$ and $B_2O_3^+$ were observed. The mixture, $B_2 + B_2O_3$, was shown to vaporize mainly as the gaseous molecule, B_2O_2. The heat of vaporization of $B_2O_2(g)$ from the condensed phase is $\Delta H_{1400}^{\circ} = 94 \pm 8$ kcal/mole. The ΔH_0° for the reaction $\frac{2}{3}B(s) + \frac{2}{3}B_2O_3(g) \rightarrow B_2O_2(g)$ is found to be 35.7 ± 3.5 kcal. The BO^+ and B^+ ions observed were found to be formed mainly in processes of dissociative ionization. The concentration of BO(g) in the vapour is at least an order of magnitude lower than that of $B_2O_2(g)$ showing the dimerization energy is greater than 99.6 kcal. Results obtained with pure B_2O_3 liquid in the Knudsen cell agree with earlier published work. A.

536.423.4 : 539.89

8733. MIST FORMATION AT HIGH PRESSURES. I.R.Krichevskiĭ and N.E.Khazanova.
Zh. tekh. Fiz., Vol. 26, No. 2, 422-9 (1956). In Russian.

Supersaturation and precipitation of a mist in a liquid–gas system can be achieved at high pressures by isothermal expansion, making use of the phenomenon of minimum solubility of the liquid in the gas corresponding to a certain pressure. Study of mist formation in systems benzene–nitrogen, methanol–nitrogen, and carbon tetrachloride–nitrogen at pressures up to 900 kg/cm^2 shows that critical supersaturation at high pressures is much lower than at atmospheric pressure. The results are in qualitative agreement with the Volmer–Farkas theory. The apparatus is described in great detail. A.Gelbtuch

536.468 : 541.126.2

8734. ON THE IGNITION OF A MOVING COMBUSTIBLE GAS STREAM. P.L.Chambré.
J. chem. Phys., Vol. 25, No. 3, 417-21 (Sept., 1956).

The ignition phenomenon in a chemically reactive gas flowing about a heated body is discussed. Specifically the conditions at the forward stagnation point of the object are analysed. A condition is formulated which relates the critical surface temperature for ignition with those parameters which control the heat and mass transport and the reaction kinetic mechanism. A.

536.468 : 541.126.2

8735. ON THE BURNING RATE OF CARBON MONOXIDE. R.Friedman and J.A.Cyphers.
J. chem. Phys., Vol. 25, No. 3, 448-57 (Sept., 1956).

Burning velocity measurements of the CO–O_2–N_2–H_2O system were made with the flat-flame burner technique. The plan of experimentation was to vary the H_2O content, the equivalence ratio, and the pressure, while holding the flame temperature constant by controlling the proportion of N_2 in the mixture. The results could be represented empirically by the relation:

$$v_u^2 = 3.8 \times 10^6 (CO)_u (H_2O)_u^{0.5} (P/P_{atmos})^{-0.24} \exp(-11\,130/T_b),$$

where v_u is burning velocity (cm/sec), $(CO)_u$ and $(H_2O)_u$ are mole fractions in the unburned gas, P is pressure, and T_b is burned-gas temperature. The Zeldovich, Frank–Kamenetsky, and Semenov equation was used to obtain an "over-all" activation energy (20 kcal) and frequency factor for the process, and the CO oxidation rate in this type of flame was then compared with the rate at which the CO forming as an intermediate in a lean hydrocarbon-air flame is oxidized in the downstream portion of such a flame. The comparison showed that, at comparable conditions, the CO oxidized 5.6 times as fast in the CO flame as in the hydrocarbon flame. Temperature traverses in hydrocarbon-air flames to which large proportions of H_2O have been added showed the rate of CO oxidation to be slightly increased thereby. Equilibrium concentrations of the species H, OH and O in the burned gases were calculated for a variety of CO–O_2–N_2–H_2O mixtures, all at the same flame temperature, and correlations with burning velocity were sought. The square of the burning velocity was found to be directly proportional to $(OH)_b(CO)_b^{0.72}$; alternatively, the group $(H)_b(O_2)_b^{0.136}$ gave equally good correlation. A third successful grouping was $[(H)_b + 0.15(OH)_b]^{1/2}$. The writers are not convinced that correlations of this type reveal the burning mechanism. A.

536.48 : 535.324

8736. THE INDEX OF REFRACTION OF LIQUID HELIUM. M.H.Edwards.
Canad. J. Phys., Vol. 34, No. 8, 898-900 (Aug., 1956).

Changes in the refractive index n with temperature have been measured between 1.5 and 4.2°K with a Jamin refractometer. The absolute values of n were deduced by comparing at one temperature the change of $(n^2 - 1)/(n^2 + 2)$ with the accurately known coefficient of thermal expansion β (Abstr. 4598/1955). Inversely, values of β above the λ-point could be deduced, for which accurate data had not been available so far. H.London

536.48

8737. PHASE SEPARATION IN He^3–He^4 SOLUTIONS. G.K.Walters and W.M.Fairbank.
Phys. Rev., Vol. 103, No. 1, 262-3 (July 1, 1956).

A container is used which consists of three sections separated by fine holes and arranged as a vertical column. The container is supplied with solutions of He^3 in He^4 of 40% and of 60% concentration. Magnetic resonance experiments in a vertical magnetic field reveal a shift in the resonance frequency from section to section. By comparing amplitudes an estimate of the concentrations in the different sections is made. Results are interpreted as indicating a separation of the mixtures into two phases. On the basis of plausible assumptions the densities and susceptibilities of mixtures are deduced as functions of the concentration and used for deriving an approximate phase diagram. The two-phase curve is plotted as a function of the temperature; it is convex and has a maximum at 60% He^3 and 0.8°K. R.Eisenschitz

536.48 : 539.152.2

8738. NUCLEAR RESONANCE EXPERIMENTS ON PURE He^3 UNDER PRESSURE. G.K.Walters and W.M.Fairbank.
Phys. Rev., Vol. 103, No. 1, 263-4 (July 1, 1956).

Relative densities were determined from measurements as a function of pressure of the strength of the nuclear resonance absorption signal from a He^3 sample of constant volume. Representative values are 0.0815, 0.0847, 0.101 and 0.114 g/cm^3 at 0, 0.97, 10.8 and 32.8 atm respectively, at 1.2°K, the value at 0 atm being assumed from Kerr's work (Abstr. 897/1955). The compressibility is about 3% per atm at 0 atm and the density is independent of temperature between 0.2° and 1.2°K within 1%. D.H.Whiffen

536.48

8739. HEAT CONDUCTIVITY AND VISCOSITY OF LIQUID ^{3}He. B.K.Agarwal.
Progr. theor. Phys., Vol. 14, No. 5, 493-4 (Nov., 1955).

The author asserts that the transport properties of liquid He^3 can be derived with reasonable accuracy from an ideal Fermi-gas model. He continues to show that these properties can also be accounted for if a "solid like" model is employed. The argument depends upon the use of various formulae the validity and mutual compatibility of which is not examined. R.Eisenschitz

536.48

8740. ON SOLUTIONS OF He^3 and He^4. S.K.Trikha and V.S.Nanda.
Progr. theor. Phys., Vol. 15, No. 2, 178-180 (Feb., 1956).

Assumptions are made regarding the dependence of Gibbs' free energy of liquid He^4 upon the temperature and the concentration of the superfluid component; in addition further assumptions are made, regarding the dependence of the free energy of mixtures on the concentration of the components, their free energy and (explicitly) the concentration of the superfluid component. From these assumptions and by a fairly direct deduction the dependence of the λ-temperature upon the concentration is obtained. Agreement with experiment is moderately good. R.Eisenschitz

536.48

8741. VAPOR PRESSURE OF THE SOLUTION OF He^3 in He^4. S.K.Trikha and V.S. Nanda.
Phys. Rev., Vol. 103, No. 3, 831-2 (Aug. 1, 1956).

Assumptions laid down in a previous note (preceding abstract) are used for calculating partial equilibrium pressures over the mixtures of the two helium isotopes. The excess of total pressure over the saturation pressure of pure He^4 is plotted against the temperature (1.0-2.5°K) and compared with

xperiment. Whereas agreement is not very good it is still better than the agreement of theoretical curves as put forward by other authors. R.Eisenschitz

536.48

8742. A MACROSCOPIC THEORY OF He^3—He^4 MIXTURES. B.K.Agarwal.
Z. Phys., Vol. 146, No. 1, 9-26 (1956).

A macroscopic theory of liquid He^3—He^4 mixtures is developed, analogous to the smoothed potential theory of Heer and Daunt, when the energy spectrum has the generalized form $E = Ap^{1/r}$. Taking r to be a function of atomic volumes of the two isotopes in the mixture, the observed data on the shift of lambda temperature, vapour pressure, heat of mixing etc. is accounted for satisfactorily. A quantitative agreement between the theory and measurements of specific heat, normal fluid density and second sound velocity in mixtures is reached by taking a temperature dependent effective mass of He^4 particles below the lambda temperature, for which a physical picture is provided. Calculations on second sound velocity show that He^3 moves with the same velocity as the normal component of He^4, which is in agreement with the heat flush experiments. A.

536.48

8743. OSCILLATIONS OF LIQUID HELIUM IN A U-TUBE. R.J.Donnelly and O.Penrose.
Phys. Rev., Vol. 103, No. 5, 1137-44 (Sept. 1, 1956).

Frictional forces in He II were studied by observing the decay of free oscillations in a U-tube. The decay, unlike that for ordinary liquids (including He I), is characterized by two logarithmic decrements: one for amplitudes of oscillation below about 0.1 cm, and another for amplitudes between about 0.2 and 1 cm. The values of these two decrements agree with the results of a hydrodynamical calculation which assumes that for the lower range of amplitudes the two-fluid equations of Landau and Tisza hold, and that for the other range of amplitudes the normal and superfluid components have identical velocity fields. The values for the viscosity coefficient deduced from the observations agree roughly with each other and with the published results of other methods. Despite the large experimental error, there is evidence that the viscosity when the two components move together is higher than the viscosity of the normal component when the two-fluid equations hold, the ratio being about 1.33 : 1. The transition between the two types of behaviour is fairly sharp near the lambda-point but becomes diffuse as the temperature is lowered to 1°K. At a given temperature, the transition appears to be sharper the more gentle the bend of the U-tube, that is, the more uniform the velocity over the walls of the tube. A.

536.58 : 539.217 : 621.316.728

8744. THE APPLICATION OF TITANIUM HYDRIDE IN EXPERIMENTAL TECHNIQUE. Z.Trousil.
Czech. J. Phys., Vol. 6, No. 2, 196-8 (April, 1956). In Russian

Simple power or heat transfer controllers utilize the completely reversible phenomenon of titanium hydride to absorb or secrete hydrogen dependent on slight temperature variations which is especially sensitive in the range of 650-700° C at a pressure of 1 kg/cm² (5 cm³ hydrogen per g titanium per °C). For power control the hydrogen operates a mercury switch which closes or opens the power circuit. For heat transfer control the hydrogen pressure in a gap between two polished metal plates regulates the amount of heat transferred from one to the other. F.Busemann

536.6 : 538.69 : 621.317.784.029.6

A MICROWAVE THERMISTOR CALORIMETER. See Abstr. 8885

536.63

8745. EMPIRICAL RELATION FOR CALCULATION OF SPECIFIC HEAT OF NORMAL PARAFFINS. V.S.Gupta.
J. chem Phys., Vol. 25, No. 2, 373-4 (Aug., 1956).

Compares results from three equations, involving as a variable the number of carbon atoms, with experimental results for fourteen paraffins. F.E.Hoare

536.63 : 536.66 : 536.75

8746. THERMODYNAMIC PROPERTIES OF THE TITANIUM CHLORIDES. D.Altman, M.Farber and D.M.Mason.
J. chem. Phys., Vol. 25, No. 3, 531-6 (Sept., 1956).

From a series of ten different experiments performed at this laboratory and from experiments reported elsewhere, the following thermodynamic properties have been obtained [$\Delta H_{f_{298}}$ in kcal/mole and S^0_{298} in cal.(°C.mole)$^{-1}$] : $TiCl_4(l)$, $\Delta H_{f_{298}} = -191.2$; $TiCl_4(g)$, $\Delta H_{f_{298}} = -181.6$; $TiCl_3(s)$, $\Delta H_{f_{298}} = -170.7$, $S^0_{298} = 34.4$; $TiCl_3(g)$, $\Delta H_{f_{298}} = -128.7$, $S^0_{298} = 74.9$; $TiCl_2(s)$, $\Delta H_{f_{298}} = -120.6$, $S^0_{298} = 24.7$; $TiCl_2(g)$, $\Delta H_{f_{298}} = -69.4$, $S^0_{298} = 65.9$. A theoretical value for S^0_{298} of 56.1 was calculated for TiCl(g). Estimated values for the C_p of these compounds are also included. A.

536.631 : 536.413.2 : 539.89

CERTAIN THERMODYNAMIC PROPERTIES OF A SOLID UNDER HIGH PRESSURE. See Abstr. 8441

536.633

8747. TEMPERATURE DEPENDENCE OF THE HEAT CAPACITY OF GASES. H.M.Spencer.
J. chem. Phys., Vol. 25, No. 2, 357 (Aug., 1956).

Contrary to Bernstein's suggestion (Abstr. 5055-6/1956) no one three-constant power series in a T equation will most satisfactorily represent the heat capacity over the temperature ranges of interest. Various equations are examined as well as the reasons for adopting particular representations. F.E.Hoare

536.66

8748. CALORIMETRIC DETERMINATION OF HEATS OF FORMATION OF TITANIUM CHLORIDES. W.F.Krieve, S.P.Vango and D.M.Mason.
J. chem. Phys., Vol. 25, No. 3, 519-23 (Sept., 1956).

The heats of formation of $TiCl_4(l)$, $TiCl_3(s)$ and $TiCl_2(s)$ were determined by chlorinating Ti, $TiCl_3(s)$ and $TiCl_2(s)$, respectively, in a nickel-bomb calorimeter to give $TiCl_4(l)$. The directly measured heat of chlorination at 25° of Ti is -190.0 ± 0.4, of $TiCl_3(s)$ is 20.9 ± 0.1 and of $TiCl_2(s)$ is 69.9 ± 0.8 kcal/mole. Relative to a value for the heat of formation of $TiCl_4(l)$ of -190.0 ± 0.4, the corresponding values for the heats of formation of $TiCl_3(s)$ and $TiCl_2(s)$ are -169.1 ± 0.4 and -120.1 ± 0.8 kcal/mole, respectively. A.

THERMODYNAMICS 536.7/.8

536.7 : 538.3

8749. THE THERMODYNAMICS OF BODIES IN STATIC ELECTROMAGNETIC FIELDS. V.Heine.
Proc. Cambridge Phil. Soc., Vol. 52, Pt 3, 546-52 (1956).

The thermodynamic behaviour of a body in a static electromagnetic field depends only on the field over the region of the body itself, whence its own thermodynamic behaviour is determined even in the presence of other polarizable media. Its behaviour depends only on the entropy density, for in fact no real energy density need exist. Also new formulae are developed for the energy and for the entropy of a body in electric and magnetic fields, including those due to permanent magnets. A.

536.7

8750. THE MACROSCOPIC THEORY OF IRREVERSIBILITY. R.O.Davies.
Rep. Progr. Phys., Vol. 19, 326-67 (1956).

This article reviews certain aspects of irreversible thermodynamics. There are two main parts. The first part

considers the Onsager theory of the approach to equilibrium of isolated systems under non-uniform conditions. The whole system is treated as being made up of macroscopic but small sub-systems, which are in "local equilibrium" in the sense that they can be described in terms of the same variables as are needed in equilibrium. Applications dealt with include (a) the transfer of matter and energy between two phases (including the Joule–Kelvin effect); (b) the equations of motion of a viscous fluid in an external field. The second part considers the case of uniform systems which are not fully describable in terms of the equilibrium variables but which may still be treated phenomenologically by introducing ordering parameters. They are usually described as "relaxing systems". The examples discussed are (a) the approach to equilibrium of glass-forming liquids, (b) ultrasonic absorption, (c) viscoelasticity (which involves tensorial ordering parameters). The review concludes with bibliographical notes on those parts of irreversible thermodynamics not considered earlier. A.

536.71

8751. ON THE EQUATION OF STATE OF THE RARE GAS ELEMENTS Ne, A, Kr AND Xe AT THE ABSOLUTE ZERO OF TEMPERATURE. P.Gombás and O.Kunvári.
Acta phys. Hungar., Vol. 5, No. 3, 339-45 (1955). In German.

Taking into account exchange and correlation effects on a statistical atomic model, numerical values of the atomic volume of rare gases at 0°K are obtained for pressures up to about 250 000 atm. R.O.Davies

536.75 : 534.23

8752. IRREVERSIBLE PRODUCTION OF ENTROPY AND THE ABSORPTION OF SOUND. O.Nomoto.
J. Phys. Soc. Japan, Vol. 11, No. 8, 818-26 (Aug., 1956).

Molecular absorption of sound was ascribed to the irreversible production of entropy due to heat conduction under finite temperature difference between the external and the internal degrees of freedom of the molecules. An absorption formula was obtained in this manner and was found to be in agreement with the known formulae obtained by other methods. A.

536.76

8753. CLAPEYRON EQUATION FOR MULTICOMPONENT SYSTEMS. J.C.M.Li.
J. chem.Phys., Vol. 25, No. 3, 572-4 (Sept., 1956).

The Clapeyron equation is derived for a multi-component system and illustrated with specific examples including the change of dew point with pressure for gaseous mixtures of fixed composition. A.

ELECTRICITY 537

537.132

8754. EFFECT OF MELTING ON POSITRON LIFETIME. H.S.Landes, S.Berko and A.J.Zuchelli.
Phys. Rev., Vol. 103, No. 3, 828-9 (Aug. 1, 1956).

Measurements of the triplet lifetime (τ_3) of positrons in naphthalene are reported. Up to a few degrees centigrade below melting point, τ_3 is 1.14×10^{-9} sec, rising to 2.68×10^{-9} sec at and above melting point (80.2°C). The percentage of positrons annihilating with τ_3 increases sharply (within 0.2°C interval) from 9% to 29% on melting. J.J.Wilkins

ELECTROSTATICS. DIELECTRICS 537.2

537.213

8755. VOLTAIC POTENTIALS OF MONOMOLECULAR FILMS IN ELECTRIC FIELDS. G.Strohrmann.
Ann. Phys. (Leipzig), Vol. 18, No. 1-2, 80-103 (1956). In German.

The voltaic potential difference between a 0.01 n-HCl solution and a film floating on this solution was determined by means of a device in which the balance beam of a sensitive torsion balance acted as an electrometer needle. During this measurement an electrostatic field was applied normally to the surface of the liquid, and the strength of the field was varied between 20 and 700 V/cm. The potentials measured at a low field strength agreed in magnitude and accuracy with the results obtained by means of other conventional methods. In the case of condensed films a relation between the voltaic potential and field strength was not found, but for gaseous films deviations of up to 20% were observed. The voltaic potentials in strong electric fields were determined from small vertical displacements of the liquid surface, which occur in electric fields and depend on the voltaic potential, the displacements were measured by means of an interference method. There are: a brief historical survey; a detailed description of the experiments; some theoretical explanations relating to the principles of the measurement, effect of surroundings and of electric fields; descriptions of the apparatus; and results of actual measurements. In the case of films of caprinic acid and heptoic acid a noticeable increase in the voltaic potential with the applied fields was observed. J.Smuts

537.226

8756. SOME DIELECTRIC PROPERTIES OF YELLOW LEAD OXIDE. A.Bergstein.
Czech. J. Phys., Vol. 6, No. 2, 164-9 (April, 1956). In German.

The resistivity, permittivity and loss tangent of polycrystalline sintered specimens have been measured at frequencies up to 10 Mc/s and temperatures between 20° and 150°C. From the results, which show a dispersion in 1 kc/s permittivity at 50° to 80°C, it is deduced that two distinct polarization mechanisms operate, the low frequency–low temperature one being associated with polarized domains whose orientation can be reversed by an external field. This is concluded from oscillograph records of polarization/field loops, whose shape suggests hysteresis effects. There is also a temperature hysteresis insofar as the loss tangent at 1 kc/s is reduced after heating to 120°C and only returns to the original value after 24 hours. The permittivity at 20°C and 1 Mc/s, corrected for sample porosity, is 50 to 60, the loss tangent is 3 to 8×10^{-3} and the d.c. conductivity is 2 to 5×10^{7} ohm.cm. K.W.Plessner

537.226

8757. ELECTRICAL AFTER-EFFECTS IN ROCHELLE SALT. K.N.Karmen.
Zh. éksper. teor. Fiz., Vol. 29, No. 4 (10), 533 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 3, 578-80 (May, 1956).

The investigations showed that considerable unipolarity is inherent in most of the specimens and that this unipolarity is a permanent characteristic. Prolonged action of electrical polarization is able to alter the unipolarity considerably, in particular to cause its disappearance. The disappearance of unipolarity indicates a transition from an "inherent" condition to one in which the forward and reverse directions of spontaneous polarization are equally likely. The precise mechanisms still remain unexplained. W.Bardsley

537.226.1

8758. THEORY OF THE DIELECTRIC CONSTANT AT HIGH FIELD STRENGTHS. A.D.Buckingham.
J. chem. Phys., Vol. 25, No. 3, 428-34 (Sept., 1956).

A discussion of the phenomenon of dielectric saturation is presented, and Debye's theory for an assembly of independent molecules is extended to include the field dependence of the molecular polarizability. Also a rigorous theory of the field-dependent dielectric constant of a dense medium is deduced. It is found that a relationship valid at all densities exists between this dielectric constant and the molecular Kerr constant, and the experimental data on liquid carbon disulphide

re in good agreement with the theory. The saturation effect n dilute solutions of anisotropically polarizable substances vith large dipole moments is also discussed, and the experimental results for dissolved nitrobenzene agree well with the heory. A.

537.226.2

759. NEW NON-FERROELECTRIC DIELECTRICS POSSESSING VERY HIGH DIELECTRIC CONSTANTS AND LOW CONDUCTIVITY. G.I.Skanavi and E.N.Matveeva. Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1047-51 (1956). In Russian.

It is shown that the combination of an internal field which favours polarization and of relaxation polarization of ions yields a very high dielectric constant in a broad frequency range (up to ultra-high frequencies) in the absence of spontaneous polarization and other ferroelectric properties. Non-ferroelectric dielectrics with $\epsilon \sim 1000$ and low conductivity have been obtained. A.

537.226.2 : 539.185

760. EFFECT OF PILE IRRADIATION ON THE DIELECTRIC CONSTANT OF CERAMIC $BaTiO_3$. F.T.Rogers, Jr. J. appl. Phys., Vol. 27, No. 9, 1066-7 (Sept., 1956).

A specimen of ceramic $BaTiO_3$, made of reagent-grade materials at a calcination temperature of 1250° C, was exposed to pile irradiation in the amount of $nvt = 2.1 \times 10^{20}$. The original ceramic showed a peak in the dielectric constant v. temperature curve usually ascribed to ferroelectricity. After irradiation this peak essentially disappeared, and the dielectric constant was reduced to a nearly constant value over the temperature range 30° C to 140° C. This reduced value is about half of the room-temperature dielectric constant as determined before irradiation. Evidence is mentioned for a small residual peak in the dielectric constant of the irradiated specimen. A.

537.226.2

8761. DIELECTRIC BEHAVIOR OF LEAD TITANATE AT LOW TEMPERATURE. J.Kobayashi, S.Okamoto and R.Ueda. Phys. Rev., Vol. 103, No. 3, 830-2 (Aug., 1, 1956).

The dielectric constant of pure ceramic $PbTiO_3$ has been measured over the temperature range $0° C \geq T \geq -170° C$. Small but distinct discontinuities in ϵ were observed at $-100° C$ and at $-150° C$, and there was a marked change in slope $(d\epsilon/dT)$ in the region of $-60° C$. The discontinuity at $-100° C$ is associated with the onset of a superstructure in which the oxygen ions in different sub-lattices are displaced in anti-parallel directions. L.E.Cross

537.226.2 : 539.133

DETAILED STRUCTURE OF COPOLYMERS FROM DIELECTRIC MEASUREMENTS. See Abstr. 8917

537.226.3

8762. THE STRUCTURE OF SOLIDS AND DIPOLAR ABSORPTION IN THE HERTZIAN REGION OF ORGANIC COMPOUNDS: CAMPHOR AND ITS DERIVATIVES. M.Freymann. J. Phys. Radium, Vol. 17, No. 4, 326-9 (April, 1956). In French.

Between its transition point at 245° K and its m.pt. camphor shows a dielectric loss and dispersion measurable at 9560 Mc/s which is relatively insensitive to sample origin and impurities. The low-frequency, 10 kc/s loss region below 200° K is very sensitive to fenchone impurity but the maximum loss is not proportional to the fenchone concentration. Pure synthetic camphor is lossless in this region. D.H.Whiffen

537.226.31

8763. DIELECTRIC BEHAVIOR OF KAOLINITE AND DICKITE. J.van Keymeulen. J. chem. Phys., Vol. 25, No. 2, 363-4 (Aug., 1956).

The dielectric losses in a sample of kaolinite and in several samples of dickite have been measured over the frequency range 100 c/s to 200 kc/s at temperatures up to about 300° C. Plots of log tan (loss angle) v. log (frequency) show broad maxima for the kaolinite sample; the frequency at the maximum increases with temperature as $\exp(-0.65\ eV/kT)$, suggesting a thermally activated loss mechanism. In contrast, the loss factor of the dickite samples shows no maximum, but decreases steadily with increasing frequency and decreasing temperature. A.B.Lidiard

537.226.31

8764. MECHANICAL AND DIELECTRIC LOSSES OF POLYISOBUTYLENE, S.P.Kabin and G.P.Mikhaĭlov. Zh. tekh. Fiz., Vol. 26, No. 3, 511-15 (1956). In Russian.

Work on these by other authors (J. Colloid Sci., Vol. 8, No. 1, 1-34, 1953) showed that they have at any given frequency a similar relationship. Previous work (Abstr. 7207/1953) showed maxima of relaxation losses at −18° C and −38° C at 100 c/s. The present paper investigates the amplitude absorption coefficient and the velocity of longitudinal ultrasonic waves for temperatures from −100 to +50° C and frequencies from 0.5 to 3.5 Mc/s. Only one maximum was observed. The measurement of polyisobutylene and polyethylene mixtures showed that the maximum is not displaced with change of concentration, indicating the mechanical character of the mixture. The graph of log $f_m = \varphi(1/T)$ is based on points deduced from mechanical and dielectric losses which lie on the same straight line and whose slope gives an activation energy 16.1 kcal per mol. The line common for all points indicates that both relaxations are connected with the same elements of the structure. M.W.Makowski

ELECTRIC CONDUCTION. CURRENTS 537.3

537.311.1

8765. A METHOD OF CALCULATION OF ELECTRICAL CONDUCTIVITY. H.Nakano. Progr. theor. Phys., Vol. 15, No. 1, 77-9 (Jan., 1956).

An application of the theory of relaxation phenomena (Kubo and Tomita, 1954) enables a theoretical study of the theory of electrical conductivity to be made. C.A.Hogarth

537.311.3 : 539.11

8766. THE ELECTRICAL CONDUCTIVITY OF CERTAIN COMPOUNDS OF TRANSITION METALS WITH BORON, CARBON AND NITROGEN, AND THEIR ALLOYS. G.V.Samsonov. Zh. tekh. Fiz., Vol. 26, No. 4, 716-22 (1956). In Russian.

From resistivity measurements on a range of nitrides, carbides and borides of transition metals and on some of their alloys, a qualitative connection is deduced between the variations of conductivity and the degree of emptiness of the d- and f-electron levels in the appropriate metal. J.B.Arthur

537.311.32

8767. EFFECT OF MINOR ADDITIONS ON THE RESISTIVITY OF FERRITES. J.P.Suchet. J. chem. Phys., Vol. 25, No. 2, 368 (Aug., 1956).

The resistivity of a commercial manganese-zinc ferrite with 9% porosity is greatly decreased by minor additions of cuprous oxide. It is suggested that in the surface layer of the grains oxidation during cooling affects much more the cuprous ions than the ferrous ones. W.Good

537.311.33

8768. THEORY OF THE TRANSVERSE MAGNETO-THERMOELECTRIC EFFECT IN SEMICONDUCTORS. M.Rodot. C.R. Acad. Sci. (Paris), Vol. 243, No. 2, 129-32 (July 9, 1956). In French.

The size of the Seebeck effect Q is modified by the presence of a transverse magnetic field H. The laws of this effect are established in part by the Boltzmann equation, and in particular the precise expression of Q (H) depends on the dis-

persion of the charge carriers. The general, degenerate and non-degenerate cases are considered, together with the effect of mobility on the saturation of Q (H) and of the field on the mobility. Measurements on InSb, to be published, confirm that a high mobility is necessary in order to observe an appreciable effect. W.Bardsley

537.311.33

8769. THEORY OF CYCLOTRON RESONANCE ABSORPTION IN MANY-VALLEY SEMICONDUCTORS. L.Gold, W.M.Bullis and R.A.Campbell.
Phys. Rev., Vol. 103, No. 5, 1250-2 (Sept. 1, 1956).

A general theory of cyclotron absorption, appropriate for energy-dependent scattering processes, is developed for electron diamagnetic resonance in germanium and silicon. An examination of the absorption arising from intravalley lattice scattering for nondegenerate electrons in germanium based on the restriction of an isotropic, energy-independent mean free path is made over temperatures ranging from liquid nitrogen to liquid helium for the resonance associated with the directional combination of magnetic and electric fields H[001], E[1$\bar{1}$0]. Comparison with the findings associated with the assumption of a constant mean free time reveals that precise absolute power absorption measurements would be required to distinguish between these two mechanisms. A.

537.311.33

8770. APPLICATION OF THE METHOD OF GENERATING FUNCTION TO RADIATIVE AND NON-RADIATIVE TRANSITIONS OF A TRAPPED ELECTRON IN A CRYSTAL. R.Kubo and Y.Toyozawa.
Progr. theor. Phys., Vol. 13, No. 2, 160-82 (Feb., 1955).

Discusses the shape of the absorption band and the probability for nonradiative transition of a trapped electron in an insulating or semiconducting crystal, especially their temperature dependence. A model for the vibrational motion of the lattice as general as possible was chosen, the normal modes for any two electronic states being different as regards not only their equilibrium positions but also the principal axes and frequencies. For nonradiative transition, in comparatively general cases, the high- and low-temperature behaviour of the probability were derived, which correspond to process through activated states and to tunnelling of the lattice co-ordinates, respectively. The result is applied to calculations of the probability for thermal ionization of trapped electrons (or holes) and the capture cross-section of impurities for free electrons (or holes) in nonpolar semiconductors. Further, the high-temperature expansion of a density matrix is used to discuss the transitions on a very general model in which lattice vibration is no longer of harmonic gap. Two problems related to the degeneracy of electronic states are discussed briefly. A.

537.311.33 : 535.822 : 535.417

THICKNESS MEASUREMENT OF SURFACE LAYERS ON SEMICONDUCTORS. See Abstr. 8705

537.311.33 : 537.581

ON THERMIONIC EMISSION IN SEMICONDUCTORS. See Abstr.8849

537.311.33 : 535.343

8771. INFRA-RED ABSORPTION IN SEMICONDUCTORS. H.Y.Fan.
Rep. Progr. Phys., Vol. 19, 107-54 (1956).

Infra-red absorption in semiconductors is classified into four different types according to the mechanism: (i) intrinsic absorption associated with electron excitation across the energy gap; (ii) absorption due to the presence of free carriers; (iii) absorption associated with impurities or lattice defects; and (iv) absorption associated with lattice vibration. A general introduction is followed by some theoretical discussions. Electron excitation between different energy bands is discussed with emphasis on the intrinsic absorption edge. For the absorption by free carriers, the effects of electron scattering by lattice vibration and by impurity centres are considered. Absorption associated with localized electronic states is briefly discussed. Experimental results are discussed for four different semiconductors: germanium, silicon, indium antimonide, and tellurium. All four types of absorption have been investigated to some extent for germanium and silicon. The work done on these materials provides a pattern for infra-red studies on semiconductors. The absorption edge in indium antimonide is affected by the carrier concentration. Long wavelength absorption shows interesting behaviour, and the observed effects attributed to lattice vibration have provided information regarding the type of binding in the crystal. Tellurium, having an optical axis, is doubly refracting. Both the absorption edge and the absorption associated with free carriers depend on the direction of polarization of the radiation. A.

537.311.33

8772. ON THE LETTER TO THE EDITOR BY I.M. TSIDIL'KOVSKIĬ AND F.G.BASS. G.M.Avak'yants.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 806 (1956). In Russian.

A rebuttal of the criticism by Tsidil'kovskiĭ and Bass (see Abstr. 8683/1955) of the author's papers (see Abstr. 887 and 888/1955). The author maintains the validity of his analysis of thermo-electric, and galvano-, thermo-, and photomagnetic effects in semiconductors subjected to strong electric fields. C.H.L.Goodman

537.311.33

8773. ON THE CONTRIBUTION OF ELECTRONS TO THE OPTICAL PROPERTIES OF SEMICONDUCTORS. E.Groschwitz and R.Wiesner.
Z. angew. Phys., Vol. 8, No. 8, 391-8 (1956). In German.

The theory of absorption due to free electrons, taking germanium as an example, is investigated. The published data on the optical constants as functions of frequency of light, temperature, and impurity concentration are summarized and discussed. It is concluded that the most interesting frequency range in which the electronic part of the absorption is dominant is in that region of the spectrum, i.e. the far infrared and millimetre wave, where time measurement is most difficult. Thus it is not at present possible to obtain a complete correlation between theory and experiment. C.A.Hogarth

537.311.33

8774. THERMO- AND GALVANOMAGNETIC EFFECTS IN SEMICONDUCTORS TAKING ACCOUNT OF VARIATIONS IN CARRIER CONCENTRATION. II. GALVANOMAGNETIC EFFECTS IN STRONG FIELDS. THERMAL CONDUCTIVITY OF ELECTRONS AND EXCITONS. G.E.Pikus.
Zh. tekh. Fiz., Vol. 26, No. 1, 36-50 (1956). In Russian.

Continuation of previous work (see preceding abstract). Treats electrical conductivity, Hall effect, magnetoresistance; electronic thermal conductivity and the transport of heat by excitons. J.M.Radcliffe

537.311.33

8775. THERMO- AND GALVANOMAGNETIC EFFECTS IN SEMICONDUCTORS TAKING ACCOUNT OF VARIATIONS IN CARRIER CONCENTRATION. I. THERMO- AND GALVANOMAGNETIC EFFECTS IN WEAK FIELDS. G.E.Pikus.
Zh. tekh. Fiz., Vol. 26, No. 1, 22-35 (1956). In Russian.

Extensive calculations taking account of recombination in the bulk and at the surface for some simply shaped specimens when the fields are so weak that the carrier concentration is only slightly different from its equilibrium value. The following effects are discussed: thermoelectric power, Hall effect, magnetoresistance, electrical resistance in a temperature gradient, the Ettingshausen effect, behaviour in oscillating fields. J.M.Radcliffe

537.311.33

776. RECOMBINATION OF ELECTRONS AND HOLES IN HE PRESENCE OF TRAPS OF DIFFERENT TYPES. .G.Kalashnikov.
h. tekh. Fiz., Vol. 26, No. 2, 241-50 (1956). In Russian.

In a semiconductor the degree of occupation of traps of a iven type is altered by the presence of traps of another type. is found that the probabilities of recombination for such sets f traps are not usually additive. It is shown that under certain onditions the presence of a relatively large number of traps, hich of themselves would have little effect on lifetime or conuctivity, can markedly reduce lifetime when combined with a mall number of a second type of trap. C.H.L.Goodman

537.311.33

777. ON THE QUESTION OF THE EFFECT OF A STRONG ELECTRIC] FIELD IN SEMICONDUCTORS. Yu.K.Pozhela.
h. tekh. Fiz., Vol. 26, No. 2, 277-80 (1956). In Russian.

Investigates the voltage-current characteristic of a point ontact (copper wire) on p-type germanium which is ohmic non-injecting) at sufficiently low potentials. For potentials bove 15-30 volts the current-voltage curve is not symmetric bout the current axis, and it is argued from this that the extra arriers produced in the high field region near the point are due o the transfer of electrons from the valence to the conduction and rather that to the ionization of impurity centres.

J.M.Radcliffe

537.311.33

778. THE DRIFT OF CURRENT CARRIERS PRODUCED Y THE ACTION OF A STRONG ELECTRIC FIELD. u.K.Pozhela.
h. tekh. Fiz., Vol. 26, No. 2, 281-3 (1956). In Russian.

See preceding abstract. Describes observation, by the sual method, of the drift of a pulse of carriers produced by he high field near a point contact. J.M.Radcliffe

537.311.33

779. EMISSIVITY OF AN ABRUPT P-N JUNCTION AND ITS FFECT ON THE CONDUCTIVITY OF THE SEMICONDUCTOR. .B.Tolpygo.
h. tekh. Fiz., Vol. 26, No. 2, 293-309 (1956). In Russian.

Approximate expressions are derived for the flow of holes nd electrons across a p-n junction. Estimates are made of a) the distribution of current between the two types of carrier, b) the degree of enhancement of conductivity near the junction ue to minority carriers,(c) the thickness of the region of enanced conductivity. Account is taken of a unimolecular reombination process for the case where the minority carrier oncentration is sufficient to swamp the recombination centres.

C.H.L.Goodman

537.311.33

3780. SPECTRAL ANALYTICAL INVESTIGATIONS OF MPURITIES IN A^{III} B^{V} SEMICONDUCTING COMPOUNDS. E.Golling.
Z. Natuforsch, Vol. 11a, No. 6, 459-63 (June, 1956). In German.

The use of the solid spectrograph is described and typical analyses of elementary impurities in the starting materials, B, Al, Ga, In, As, Sb, are given. C.A.Hogarth

537.311.33

781. COMBINED MEASUREMENTS OF FIELD EFFECT, URFACE PHOTO-VOLTAGE AND PHOTOCONDUCTIVITY. .H.Brattain and C.G.B.Garrett.
ell. Syst. tech. J., Vol. 35, No. 5, 1019-40 (Sept., 1956).

Combined measurements have been made of surface reombination velocity, surface photovoltage, and the modution of surface conductance and surface recombination elocity by an external field, on etched germanium surfaces. wo samples, cut from an n-type and a p-type crystal of nown body properties, were used, the samples being exposed o the Brattain–Bardeen cycle of gaseous ambients. Results are interpreted in terms of the properties of the surface space-charge region and of the fast surface states. It is found that the surface barrier height, measured with respect to the Fermi level, varies from −0.13 to +0.13 V, and that the surface recombination velocity varies over about a factor of ten in this range. From the measurements, values are found for the dependence of charge trapped in fast surface states on barrier height and on the steady-state carrier concentration within the semiconductor. A.

537.311.33

8782. DISTRIBUTION AND CROSS-SECTIONS OF FAST STATES ON GERMANIUM SURFACES. C.G.B.Garrett and W.H.Brattain.
Bell. Syst. tech. J., Vol. 35, No. 5, 1041-58 (Sept., 1956).

A theoretical treatment of the field effect, surface photovoltage and surface recombination phenomena has been carried out, starting with the Hall–Shockley–Read model and generalizing to the case of a continuous trap distribution. The theory is applied to the experimental results reported in the preceding abstract. One concludes that the distribution of fast surface states is such that the density is lowest near the centre of the gap, increasing sharply as the accessible limits of surface potential are approached. From the surface photovoltage measurements one obtains an estimate of 150 for the ratio (σ_p/σ_n) of the cross-sections for transitions into a state from the valence and conduction bands, showing that the fast states are largely acceptor-type. On the assumption that surface recombination takes place through the fast states, the cross-sections are found to be: $\sigma_p \sim 6 \times 10^{-15}\,\mathrm{cm}^2$ and $\sigma_n \sim 4 \times 10^{-17}\,\mathrm{cm}^2$. A.

537.311.33

8783. THE DIFFUSION DISTANCES OF ELECTRONS AND HOLES IN GERMANIUM, MEASURED BY X-RAYS. M.Malkovská.
Czech. J. Phys., Vol. 5, No. 4, 545-6 (Dec., 1955). In Russian.

"Travelling light spot" measurements of diffusion length were made on grown p-n junctions, using 40 kV X-rays and, for comparison, a normal infrared source. From the good agreement obtained it is concluded that the range of the disturbance due to the absorption of medium X-rays is much less than the diffusion length of carriers. J.B.Arthur

537.311.33 : 538.65

8784. ELASTOGALVANOMAGNETIC EFFECT AND INTERVALLEY SCATTERING IN N-TYPE GERMANIUM. R.W.Keyes.
Phys. Rev., Vol. 103, No. 5, 1240-5 (Sept. 1, 1956).

Starting from a multivalley model of a cubic semiconductor, a calculation of the effect of elastic strain on certain galvanomagnetic effects is carried out. It is found that the effects are sensitive to the strength of the intervalley scattering. An experiment on germanium to which the calculation is applicable is described. It is concluded from a comparison of the theory and the experiment that the coupling constant which characterizes the coupling of the electrons to the intervalley phonons in the model of Herring is considerably smaller than the coupling constant to the acoustic phonons. A.

537.311.33

8785. EFFECTS AT HIGH-ANGLE GRAIN BOUNDARIES IN INDIUM ANTIMONIDE. I.M.Mackintosh.
J. Electronics, Vol. 1, No. 5, 554-8 (March, 1956).

A number of experiments were made in order to compare any effects with those previously reported for germanium (Abstr. 845/1953). Small currents were passed across such boundaries in rectangular filaments of n- and p-type material and the potential gradient along the filament was investigated. All samples showed linear behaviour at room temperature, whilst at 88°K the n-type samples were linear but the p-type samples revealed large potential jumps at the boundaries. The variation in the height of the hump with temperature is

plotted and interpreted by assuming that the p-type boundaries are localized regions of high donor density. There is some speculation on the energy levels of these donors and on their origin. W.Bardsley

537.311.33

8786. CYCLOTRON RESONANCE AT INFRARED FREQUENCIES IN InSb AT ROOM TEMPERATURE. E.Burstein, G.S.Picus and H.A.Gebbie.
Phys. Rev., Vol. 103, No. 3, 825-6 (Aug. 1, 1956).

Magnetic fields up to 60 000 gauss were used and reflection and transmission measurements made in the wavelength region 25 to 42 microns. The specimen was p-type, intrinsic at room temperature, electron mobility $6 \times 10^4 cm^2$/volt sec. The theoretical consequences of the measurements are discussed. W.Bardsley

537.311.33

8787. MAGNETIC OPTICAL BAND GAP EFFECT IN InSb. E.Burstein, G.S.Picus, H.A.Gebbie and F.Blatt.
Phys. Rev., Vol. 103, No. 3, 826-8 (Aug. 1, 1956).

It could be expected that a magnetic field would have an appreciable effect on optical transitions between valence and conduction band because of the large diamagnetic splitting of the conduction band levels in the field due to the small effective electron mass. Room temperature transmission measurements with unpolarized radiation at the absorption edge in magnetic fields up to 60 000 gauss show that the field causes an appreciable shift of the edge to shorter wavelengths, interpreted as an increase in the optical band gap. The shifts of points of fixed transmission in the absorption edge are taken as an estimate of the effect. A tentative explanation in terms of the variation of density of states in the conduction band with field is given. W.Bardsley

537.311.33

8788. MAGNETORESISTANCE EFFECT OF LEAD SULPHIDE GROUP OF SEMICONDUCTORS. I. MEASUREMENTS ON NATURAL SPECIMENS OF LEAD SULPHIDE. T.Irie.
J. Phys. Soc. Japan, Vol. 11, No. 8, 840-6 (Aug., 1956).

The magnetoresistance effect of lead sulphide was measured on natural specimens at various angles between the direction of the electric field and the magnetic field. The results were quantitatively consistent with the existing phenomenological theory. The magnetoresistance constants for weak magnetic field, introduced by Seitz, were determined. Some discussions are given in the light of the electronic theory based on the approximation of spheroidal energy surface. The magnetoresistance mobility and the Hall mobility agree to the order of magnitudes and also show similar temperature dependence. A.

537.311.33

8789. THE DRIFT MOBILITY OF THE CHARGE CARRIERS IN VERY PURE SILICON. M.Zerbst and W.Heywang.
Z. Naturforsch., Vol. 11a, No. 7, 608-9 (July, 1956). In German.

Reports results of measurements on As- and B-doped silicon, having specific resistivity 200-2000 ohm cm in the pure state; it is found that at room temperature $\mu_n = 1400$, $\mu_p = 500$ $cm^2 volt^{-1} sec^{-1}$. The temperature variation is in both cases as $T^{-2.3}$ between 150° and 450° K. E.P.Wohlfarth

537.311.33 : 539.11

8790. HOLE CONDUCTIVITY IN SILVER BROMIDE. L.M.Shamovskiĭ, A.A.Dunina and M.I.Gosteva.
Dokl. Akad. Nauk SSSR, Vol. 106, No. 5, 830-3 (1956). In Russian.

In the literature theory and experiment admit of both Frenkel and Schottky defects in AgBr. An examination of the defects is made by observing the change of conductivity and the spectral response when AgBr is heated in bromine vapour. It is found that the conductivity $\sigma = 1.02 \times 10^5 \exp(-18200/RT)$ $ohm^{-1} cm^{-1}$ and $\Delta\sigma = 1.82 \times 10^2 \sqrt{\rho_{Br}} \exp(-13520/RT)$ $ohm^{-1} cm^{-1} (cm\ Hg)^{1/2}$. The experiments show that this process produces "holes" in the crystal. The mechanism is explained in terms of V-centres. W.Bardsley

537.311.33 : 621.314.63

8791. AN ELECTRON DIFFRACTION STUDY OF THE SUB-ELECTRODE LAYER IN SELENIUM RECTIFIERS WITH A CADMIUM ELECTRODE. V.A.Dorin and D.N.Nasledov.
Zh. tekh. Fiz., Vol. 26, No. 2, 284-92 (1956). In Russian.

An investigation of the "forming" of commercial Se rectifiers. Evidence of formation of cubic CdSe was obtained. It was also found that very thin films (< 0.1 μ) of Cd and Se or S, on cleaved rocksalt, can react at about 100° C to give cubic CdSe or CdS. The type of diffusion reaction involved is discussed in some detail. C.H.L.Goodman

537.311.6 : 621.317.332.029.6

8792. SURFACE RESISTANCE AND REACTANCE OF METALS AT INFRARED FREQUENCIES. J.R.Beattie and G.K.T.Conn.
Proc. Inst. Radio Engrs, Vol. 44, No. 1, 78-81 (Jan., 1956).

At frequencies > 10^{12} c/s surface reactance cannot be neglected when measuring surface resistivity by a reflection method. Measurements of surface reactance and resistance for metal films and surfaces (prepared in different ways) have been made in the frequency range 2.5×10^{13} - 1.5×10^{14} c/s by methods previously described (Abstr. 2628-9/1955). It was found that by choosing suitable values of the conductivity and relaxation time the measurements on Cu, Ag and Al could be made to exhibit a frequency dependence very close to that predicted by a simple theory of electron relaxation (Abstr. 1032/1949). Results for Ni diverged somewhat from this law for reasons which are discussed. In all cases the conductivity was less than the predicted d.c. value and in general temperature coefficients were also smaller than expected. Surface roughness of approximately 10^{-6} cm would be sufficient to account for these effects. G.D.Sims

537.312

8793. EFFECT OF THE GASEOUS ATMOSPHERE ON THE PHOTO-CONDUCTION AND SEMICONDUCTION OF AROMATIC HYDROCARBON CRYSTALS. A.Bree and L.E.Lyons.
J. chem. Phys., Vol. 25, No. 2, 384 (Aug., 1956).

Enumerates the results of experiments on very pure anthracene single crystals. The production of charges is concluded to arise from some derivative of anthracene which is proportional to the amount of adsorbed oxygen. A mechanism of charge liberation is formulated. W.Bardsley

537.312 : 537.533.9

8794. THE MEASUREMENT OF THE INDUCED CONDUCTIVITY OF AN ANTIMONY-CAESIUM CATHODE. L.Šafratová-Eckertová.
Czech. J. Phys., Vol. 5, No. 4, 551-2 (Dec., 1955). In Russian.

Changes in conductivity of an antimony-caesium cathode were observed in the presence of the electron bombardment of its surface. In order to avoid polarization effects occurring in the cathode when d.c. is passed through it, a.c. was employed during these measurements. The results show the relation between the resistance of the cathode layer and the primary electron current for various accelerating voltages and the dependence of the current passing through the layer on the primary current when the energy of the primary electrons was 650 eV. Z.F.Wojnar

537.312 : 537.531

8795. RADIATION INDUCED CONDUCTIVITY IN POLYETHYLENE AND TEFLON. R.A.Meyer, F.L.Bouquet and R.S.Alger.
J. appl. Phys., Vol. 27, No. 9, 1012-18 (Sept., 1956).

The conductivity induced in polyethylene and Teflon by

bombardment with X-rays from a 2 MeV Van de Graaff and gamma-rays from Co^{60} has been investigated as a function of time, temperature, geometry, exposure rate, and applied electric field. Within the range of the variables studied, the observed photocurrents were directly proportional to the exposure rate and the applied electric field. The photocurrent could be divided into three components, the current due to the action of monodirectional photons, the increase in this current due to the influence of the electric field, and a component of less than 10% made up of all other possible charge carriers. During irradiation, the conductivity increased by a factor of about 10^3. Between 78°K and 273°K the photocurrent was nearly independent of temperature. In general, the conductivity of Teflon was greater than that of polyethylene. A.

537.312 :537.531

8796. X-RAY INDUCED CONDUCTIVITY IN INSULATING MATERIALS. J.F.Fowler.
Proc. Roy. Soc. A, Vol. 236, 464-80 (Sept. 11, 1956).

A co-ordinated explanation of the conductivity induced by ionizing radiation in solid insulating materials (conductivity $\sim 10^{-20}$ ohm^{-1} cm^{-1}), including amber, mica and a number of plastics, is put forward for the first time. A model based on conduction by free electrons and including the presence of electron traps is proposed, and the theoretical predictions based thereon are shown to be in good agreement with the experimental results. The dependence of induced conductivity and of the subsequent decay upon temperature and dose rate have been investigated. Physical parameters are given for each material: recombination cross-section, number of traps and their distribution in energy, mean distance diffused by free electrons and probability factors of release from traps. The results suggest that when crystalline regions are present in a material (e.g. polyethylene), the boundaries of these regions provide trapping sites in addition to traps of unspecified nature which are present in completely amorphous materials. A.

537.312.5

8797. PHOTOCONDUCTIVITY IN INDIUM-DOPED SILICON. J.S.Blakemore.
Canad. J. Phys., Vol. 34, No. 9, 938-48 (Sept., 1956).

Impurity photoconductivity has been studied in silicon doped with indium, at various temperatures in the range 63-90°K. The long wave limit of spectral response and analysis of the bulk electrical properties both confirm an ionization energy of 0.16 eV for the indium centres. An apparent variation of quantum efficiency in the range 5-8 μ is noted and discussed. The magnitude of the photoconductive response suggests an effective recombination coefficient of about 10^{-6}cm^3/sec at 90°K, rising steeply on further cooling. This demands a much more active recombination mechanism than present theories provide. A.

537.312.5

8798. RELAXATION OF PHOTOCONDUCTIVITY OF SnO_2. A.I.Andrievskiĭ and V.A.Zhuravlev.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 1, 43-6 (1956). In Russian.

Thin layers of Sn obtained by vacuum evaporation were oxidized for from 2 to ~50 hours in an electric furnace at 170°C, when SnO_2 was partly transformed from amorphous into crystalline form. To attain steady-state conductivity, it was necessary to illuminate the specimens for from 10 min to 2 hours. The fall of photoconductivity after the end of illumination lasted 16-20 hours. The times of relaxation observed varied from 20 to 3000 sec. The growth of photoconductivity obeyed an exponential law, being expressed by the sum of several exponential functions each of which had a different time of relaxation. If the individual relaxation times for a specimen are τ_1, τ_2... τ_n, the following relationship exists between the reciprocal times and their numbers 1, 2, ... n: $1/\tau_n = ke^{n/p}$, where k is a coefficient which increases when the illumination increases, and $p \sim 1$. A tentative explanation of this relationship is advanced. After relatively high illuminations the decrease of photoconductivity takes place, first, according to a hyperbolic law, and obeys later an exponential law; after low-value illuminations, the decrease obeys an exponential law right from the beginning. The same formula as above (but with $p \sim 0.5$) applies to the decrease of photoconductivity. F.Lachman

537.312.5

8799. EFFECT OF GASES ON THE PHOTOCONDUCTIVITY OF ANTHRACENE. W.G.Schneider and T.C.Waddington.
J. chem. Phys., Vol. 25, No. 2, 358 (Aug., 1956).

Gases such as Cl_2 and NO_2 cause a permanent increase of photoconductivity while BF_3, HCl, SO_2, NO and O_2 are strongly adsorbed and produce an increase, removable by prolonged vacuum treatment. Suppression of photocurrent is produced by $NH_3(CH_3)_3N$, $(C_2H_5)O$, C_2H_5OH, H_2O, $(CH_3)_2CO$ but is removed on pumping. CO_2, N_2, A and $(CH_3)_4C$ have negligible effects. The first two groups are held to act as electron acceptors, reducing positive hole trapping while the third group acts in a donor capacity. The effects are associated with surface processes on the anthracene which is assumed from previous work to be a p-type conductor. G.F.J.Garlick

537.312.5

8800. LARGE-SCREEN, HIGH-CURRENT PHOTOCONDUCTIVE CELLS USING ZINC SULFIDE CADMIUM SULFIDE, OR CADMIUM SULFIDE, OR CADMIUM SELENIDE PHOSPHORS. S.Rothschild.
J. Opt. Soc. Amer., Vol. 46, No. 8, 662-3 (Aug., 1956).

It is pointed out that the preparation of photoconductive cells made by coating an insulator with a phosphor in a plastic binder described by Nicoll and Kazan (Abstr. 9672/1955) were previously developed by the author in 1943 (Brit. Pat. 566, 278, 1943). G.F.J.Garlick

537.312.5 : 535.37

8801. PHOTOCONDUCTIVITY AND LUMINESCENCE OF POLYCRYSTALLINE CdS(Cu). N.A.Tolstoĭ, B.T.Kolomiets, O.I.Golikova and M.Ya.Tsenter.
Zh. éksper. teor. Fiz., Vol. 30, No. 3, 575-6 (1956). In Russian.

Specimens with varying amounts of added Cu (10^{-6} – 10^{-3} g/g) were studied. Characteristic and parallel variations were observed in (a) steady-state photoconductivity (b) steady state luminescence (excited by 365 and 546 mμ radiation) (c) growth and decay of both photoconductivity and luminescence, as the Cu content increased. Specimens with 10^{-3} Cu and 10^{-5} Fe (g/g) were also studied. C.H.L.Goodman

537.312.5 : 537.533.8

8802. THE RADIOGRAPHIC STUDY OF X-RAY PHOTOELECTRON EMISSION S.Karal'nik, N.Nakhodkin and L.Meleshko.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 780-1 (1956). In Russian.

A thin plate of metal, placed in contact with a photographic emulsion, was exposed to 200 kV X-rays passing through the emulsion. The relative blackening due to photoelectrons and secondary electrons was measured for a range of elements and was found to increase roughly linearly with Z and not Z^5. Scattering from Zn was less than from Cu and similarly for Ag and Cd, where transition from $3d^{10}\ 4s^1$ to $3d^{10}4s^2$ takes place. A.L.Mackay

537.312.5

8803. THE ANTIMONY–LITHIUM PHOTOCATHODE. Yu.A.Nemilov and V.E.Privalova.
Zh. tekh. Fiz., Vol. 26, No. 1, 61-3 (1956). In Russian.

Sb–Li photocathodes were obtained with a sensitivity of 35-40 μA/lumen (for light of 2850° colour temperature) and a long-wave cut-off near 6200 A. Fatigue effects were very small. No sensitization by oxygen was observed. A thermo-

electric work function of 1.5 ± 0.1 eV and a thermal activation energy for electrical conduction of 1.0 ± 0.1 eV were found for the Sb–Li films, which were of both n- and p-types. The greatest photoelectric sensitivity was obtained with p-type material. C.H.L.Goodman

537.312.5 : 535.37

8804. PHOTOCONDUCTIVITY, LUMINESCENCE AND LIGHT ABSORPTION IN HgI_2 CRYSTALS. E.F.Gross, A.A.Kaplyanskiĭ and B.V.Novikov.
Zh. tekh. Fiz., Vol. 26, No. 3, 697-700 (1956). In Russian.

The dichroism of red HgI_2 was found to be reflected in the spectral response of its photoconductivity. At 77.3°K single crystal platelets irradiated by normally incident polarized light showed peaks in photoconductivity (and associated cut-offs) at wavelengths corresponding to the absorbtion edges for the ordinary and the extraordinary rays, when the plane of polarization was, respectively, perpendicular and parallel to the optical axis (which lay within the platelet). Effects connected with exciton formation were also observed in the spectral response. It was confirmed that photoconduction in HgI_2 was related to exciton formation by the observation of luminescence at the exciton line wavelength on irradiating crystals in the region of continuous absorption. At 4.2°K such luminescence consisted of two completely polarized lines which corresponded with lines observed in absorption at 5296 and 5321 A. C.H.L.Goodman

537.312.5

8805. NEGATIVE INTERNAL PHOTOEFFECT IN ZINC OXIDE. M.Borissov and S.Kanev.
Z. phys. Chem. (Leipzig), Vol. 205, No. 1-2, 56-72 (Oct., 1955). In German.

A simple method of investigating the internal photoeffects (photoconductance) of powdered semiconductors uses measurements of the dielectric loss at high frequencies. Experiments with ZnO show that both positive and negative effects can be observed, depending on the wavelength of light used, and on the temperature. The results are interpreted in terms of a band model for ZnO. C.A.Hogarth

537.312.5 : 541.14

PHOTOCONDUCTIVITY OF CdS. See Abstr. 8449

537.312.5 : 548.5

PREPARATION AND ELECTRICAL PROPERTIES OF SINGLE CRYSTALS OF ZnAs AND GaAs. See Abstr. 8464

537.312.62 : 537.312.9

8806. EFFECT OF PRESSURE ON SUPERCONDUCTING TRANSITIONS AND ON ELECTRICAL RESISTANCE AT LOW TEMPERATURES. J.Hatton.
Phys. Rev., Vol. 103, No. 5, 1167-72 (Sept. 1, 1956).

Measurements have been made on the shift of the superconducting transition temperatures of Sn, In, Hg, Tl and Ta by pressures up to 5000 kg/cm². For thallium, $\Delta T_c/\Delta P$ is initially positive but becomes negative above 1200 kg/cm². The effect of pressure on the normal resistance of all these metals, except Hg, has been investigated just above their transition temperatures. In all cases the resistance decreases under pressure. A.

537.312.62

8807. ON THE MACROSCOPIC THEORY OF SUPERCONDUCTIVITY. V.L.Ginzburg.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 748-61 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 589-600 (July, 1956).

The question of the basic equations of the macroscopic theory of superconductivity in steady and alternating fields is discussed in connection with some recent researches. Particular attention is paid to clarification of the character of the conclusions which can be made on the basis of measurements of the surface impedance of metals. A.

537.32 : 537.312.8 : 538.632

8808. THERMAL AND GALVANOMETRIC EFFECTS IN STRONG FIELDS AT LOW TEMPERATURES. G.E.Zil'berman.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 762-9 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 650-6 (July, 1956).

The thermoelectromotive force, resistance and Hall effect are considered on the basis of a two band model for a metal in a magnetic field at low temperatures. A.

537.32 : 535.37

THERMOELECTRIC PROPERTIES OF SOME OXYGEN ACTIVATED ALKALI HALIDES. See Abstr. 8111

537.322.1

8809. THERMOELECTRIC MICROREFRIGERATORS. E.K.Iordanishvili and L.S.Stil'bans.
Zh. tekh. Fiz., Vol. 26, No. 2, 482-3 (1956). In Russian.

A brief survey of progress in thermoelectric refrigeration. The best single thermoelements gave 75-80°C cooling unloaded (from 70°C). A two-stage assembly of elements gave 56.5°C cooling of a 1 litre volume (from 40°C). Single elements attached to crystal triodes enabled the maximum power output to be increased 2-3 times. A thermostat, which makes use of the reversibility of the Peltier effect, held a volume of 0.6 litre at 45°C while the ambient varied from 70° to −21°C. C.H.L.Goodman

ELECTRIC DISCHARGES 537.52

537.525 : 621.38

8810. NOTE ON DISCHARGES FROM A FLAT THERMIONIC CATHODE. N.R.Daly and K.G.Emeleus.
Brit. J. appl. Phys., Vol. 7, No. 8, 308 (Aug., 1956).

Describes experiments which show that plasmas with internal structures, as reported by Druyvesteyn and Warmolz (1937), are not confined to the cylindrical geometry used by those authors, but also appear in planar tubes with disc-shaped oxide cathodes and pressures of argon between 0.1-1.0 mm Hg. A.H.W.Beck

537.525.4 : 621.3.015.5

8811. ON THE INITIATION OF THE ELECTRICAL BREAKDOWN OF A GAP IN HIGH VACUUM. N.B.Rozanova and V.L.Granovskiĭ.
Zh. tekh. Fiz., Vol. 26, No. 3, 489-96 (1956). In Russian.

Measurements of the d.c. and impulse breakdown voltages were carried out on gaps up to 3 mm long and having electrodes made from various materials. It is found that the breakdown voltage increases with the mechanical strength of material used for the anode; the investigated materials falling into the following series in order of increasing breakdown voltage: C, Al, Cu, Fe and Ni, Mo, W. Contrary to the view held in the literature [see Phys. Rev., Vol. 43, 158-9 (Feb. 1, 1933) and Abstr. 1868 (1947)] it is found that the electrical strength of a gap increases with the intensity of the X-ray irradiation produced at the anode during the pre-discharge period. E.M.Dembinski

537.525.8

8812. MASS SPECTROMETRIC STUDY OF THE KINETICS OF NITROGEN AFTERGLOW. J.Berkowitz, W.A.Chupka and G.B.Kistiakowsky.
J. chem. Phys., Vol. 25, No. 3, 457-66 (Sept., 1956).

Lewis–Rayleigh afterglow in nitrogen has been examined by simultaneous observation with a mass spectrometer and a photomultiplier. Afterglow intensity was found to be proportional to the square of the ground-state nitrogen atom concentration under a variety of conditions. The proportionality constant was essentially unaffected by small oxygen addition, but

as somewhat increased with admixture of noble gases. vidence is presented for a linear dependence of afterglow ntensity on total pressure of nitrogen. Addition of nitric oxide o the afterglow results primarily in the production of nitrous xide. From a rough calibration of the atomic concentration ca 1%) and the afterglow radiation intensity, (10^{13} photons/cc.sec) termolecular rate constant of 2×10^{-33} c.c.^{2} molecule^{-2}.sec^{-1} s obtained. The experimental data point to a termolecular eaction involving two ^{4}S nitrogen atoms. The detailed mechnism probably involves the intermediate formation of the Σ_g^+ molecular state, followed by a collision-induced, radiaionless transition into the $^3\pi_g$ state. A.

537.525.8

8813. PRODUCTION OF THE JOSHI EFFECT IN OXYGEN UNDER THE NEAR INFRARED. S.R.Mohanty, K.R.K. Rao and T.R.Bhat.
Nuovo Cimento (Ser. 10), Vol. 3, No. 6, 1463-4 (June, 1956).

Describes experiments on the irradiation with infrared ight of electrodeless a.c. corona discharges in oxygen. Positive and negative Joshi effects were found. The bearing of these results on the explanation of the Joshi effect is discussed. J.D.Craggs

537.528

8814. ON THE DEVELOPMENT BY MEANS OF LEADERS OF THE PROCESS OF BREAKDOWN OF LIQUIDS. .E.Balygin.
Zh. éksper. teor. Fiz., Vol. 29, No. 5 (11), 708-9 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 3, 573-4 (May, 1956).

A reply to the remarks of G.A.Vorob'ev (Zh. éksper. teor. Fiz., Vol. 27, No. 6(12), 764, 1954) about a previous article (ibid., Vol. 25, No. 6(12), 738, 1953) by the author. It is emphasized hat the absence of a leader stage was mentioned in that article in the sense that the development of the breakdown process was continuous and gradual. Here a streamer or streamers lead to the principal discharge which shorts the electrodes. The concept of a leader stage was used when the breakdown was discontinuous with time. Experimental evidence for a discontinuous process in some cases is discussed. W.Bardsley

X-RAYS 537.531

537.531 : 535.33.07

8815. MEASUREMENT OF CONTINUOUS X-RAY SPECTRA WITH A SCINTILLATION SPECTROMETER. D.V.Cormack, J.E.Till, G.F.Whitmore and H.E.Johns.
Brit. J. Radiol., Vol. 28, 605-9 (Nov., 1955).

Measurements have been made with a scintillation spectrometer of the spectral distribution of primary radiation from a 280 kVp X-ray machine for half-value layers of 1.7, 2.5 and 3.1 mm of copper. The measured distributions have been corrected for crystal and photomultiplier effects using measured spectra for monochromatic radiation. The corrected distributions have been compared with those obtained by analysis of absorption data. A.

537.531 : 535.43

8816. ON THE THEORY OF X-RAY SCATTERING IN GASES, LIQUIDS, AMORPHOUS SOLIDS AND POLYCRYSTALS. I-II. V.N.Filipovich.
Zh. tekh. Fiz., Vol. 25, No. 9, 1604-21, 1622-38 (1955). In Russian.

537.531 : 535.43 : 539.133

8817. ON THE CALCULATION OF INTERATOMIC DISTANCES FROM THE RADIAL (X-RAY SCATTERING) DISTRIBUTION CURVES. V.N.Filipovich.
Zh. tekh. Fiz., Vol.26, No. 2, 417-21 (1956). In Russian.

CATHODE RAYS. POSITIVE RAYS 537.533/534

537.533 : 621.384.611

8818. TWO ELECTRON MODELS OF A CONSTANT-FREQUENCY RELATIVISTIC CYCLOTRON. E.L.Kelly, R.V.Pyle, R.L.Thornton, J.R.Richardson and B.T.Wright.
Rev. sci. Instrum., Vol. 27, No. 7, 493-503 (July, 1956).

Two model constant-frequency cyclotrons based on the principle of L.H.Thomas, as extended by D.L.Judd, are described. Both accelerated electrons to speeds of half that of light in magnetic fields of threefold azimuthal periodicity. Three 60°-wide wedge-shaped electrodes, driven 120° out of phase, provided an energy gain per revolution of 3 eV_0, where V_0 is the peak electrode-to-ground voltage. Electrons were accelerated to 75 kV with V_0 = 23 V, implying a minimum of 1000 revolutions in the cyclotron. The beam reached full energy without axial loss and it was demonstrated that essentially all of the circulating current will emerge from this type of accelerator without the use of additional deflecting systems. This work demonstrates the feasibility of a high-current, high-energy cyclotron based on the Thomas principle. A.

537.533 : 537.534

8819. INFLUENCE OF THE NEARNESS TO EXTERNAL RESONANCE ON THE MAGNITUDE OF THE CRITICAL ENERGY IN AN ACCELERATOR WITH STRONG FOCUSING. Yu.F.Orlov.
Zh. éksper. teor. Fiz., Vol. 30, No. 5, 953-5 (1956). In Russian.

537.533.2

8820. ON THE INFLUENCE OF ADSORBED MOLECULES ON PHOTOEMISSION. S.Koc.
Czech. J. Phys., Vol. 6, No. 1, 45-51 (Jan, 1956). In German.

The method of Seidl and Strelka Fysikalni vestnik, Vol. 1, No. 7, 1953. (In Czech) in which the photoemission from a metal surface is measured by incorporating it in a Geiger–Müller tube is discussed as a means of examining the processes of molecular adsorption on metal surfaces. G.F.J.Garlick

537.533.2

8821. ON THE PROBLEM OF CHEMI-EMISSION. F.Roubínek.
Czech. J. Phys., Vol. 6, No. 1, 52-5 (Jan., 1956). In German.

A method is developed (see also preceding abstract) by which the initial stage of the interaction of oxygen with a copper surface can be studied. A stage is distinguished which is most likely that in which oxygen interacts with the copper before the occurrence of an intervening oxide layer. G.F.J.Garlick

537.533.2 : 548.7 : 535.37

ELECTRON EMISSION OF X-RAY IRRADIATED IONIC CRYSTALS. See Abstr.8685

537.533.3

8822. THE FOCUSING OF ELECTRON BEAMS BY A PERIODIC LONGITUDINAL MAGNETIC FIELD. O.Cahen.
Ann. Télécomm., Vol. 11, No. 7-8, 142-50 (July-Aug., 1956). In French.

It is shown that, if a magnetic field directed along the axis of an electron beam changes its sense periodically in space, the beam may be focused as well as it would have been by a unidirectional field. The optimum form and intensity of the field (viz: those which reduce the beam to a minimum diameter) are discussed, and practical arrangements for its production are detailed. A.E.I.Research Laboratory

537.533.3

8823. AXIALLY SYMMETRICAL PACKETS OF ELECTRONS OF A GIVEN FORM. V.T.Ovcharov.
Dokl. Akad. Nauk SSSR, Vol. 107, No. 1, 47-50 (1956). In Russian.

An attempt to solve the problem of how to find the electric and magnetic fields from a given trajectory of a packet of electrons, when the effect of the spatial charge (hitherto neglected in this kind of calculations) is taken into account. The case of packets having axially symmetrical shape is investigated in some detail and the results are discussed from the point of view of practical applications, where precise boundary conditions may be required. G.Martelli

537.533.3

8824. ON CERTAIN FOCUSING PROBLEMS IN ELECTRON OPTICS THEORY. P.P.Kas'yankov.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 5, 813-16 (1956). In Russian.

Fully relativistic equations are formulated for electron trajectories in general electro- and magneto-static potentials. The conditions that these potentials must satisfy in order that the electron-optical image be planar can be obtained from a fundamental matrix property of the coordinates. In the paraxial region these conditions assume a relatively simple form. J.W.Gardner

537.533.3

8825. ABERRATIONS OF RELATIVISTIC ELECTRON BEAMS. A.M.Strashkevich and N.G.Gluzman.
Zh. tekh. Fiz., Vol. 24, No. 12, 2271-84 (1954). In Russian.

A beam consists of a set of moving electrons with the same initial velocity and trajectories close to an axial trajectory. Relativistic equations of motion are derived for a wide beam in an arbitrary electrostatic field. In this the axis may be straight or bent, e.g. a helix. The systems with a bent axis are specially interesting since they may give rise to negative chromatic aberration. The special cases considered are an axially symmetrical field, a flat field, the field of a cylindrical lens and the field of a cylindrical condenser. Image aberrations are computed for the relativistic case of an axially symmetric lens and a cylindrical lens. Mathematical Reviews

537.533.3

8826. ON ELECTRON-OPTICAL SYSTEMS WITH A RECTILINEAR AXIS NOT HAVING ROTATIONAL SYMMETRY. I.I.Chukkerman.
Zh. tekh. Fiz., Vol. 24, No. 12, 2261-63 (1954). In Russian.

The systems studied are defined as systems of static electric and magnetic fields, such that one of the trajectories of an appropriately directed beam of charged particles is a straight line, which is the axis of the system. The equations of motion for paraxial electrons are obtained. The condition for a rectilinear axis is stated. Another condition is found in order that a beam radiating from a point on the axis be brought again to a focus. Mathematical Reviews

537.533.3

8827. A METHOD OF FINDING A WIDE CLASS OF ELECTROSTATIC AND MAGNETIC FIELDS FOR WHICH THE SOLUTIONS OF THE BASIC EQUATION OF ELECTRON OPTICS ARE EXPRESSED BY MEANS OF KNOWN FUNCTIONS. B.E.Bonshtedt.
Zh. tekh. Fiz., Vol. 25, No. 3, 541-3 (1955). In Russian.

The method of finding the conditions under which the paraxial ray equation can be readily solved is based on the use of invariants of ordinary linear second-order equations and of the Schwarzian derivative. Given two such equations, with known solutions, the method shows: (i) how to use these solutions to find a function which is the solution of a paraxial ray equation, (ii) how to determine the electrostatic potential and magnetic fields from the invariants of the auxiliary equations. Examples are given where the solutions of the two auxiliary equations are Bessel functions and also where they are Legendre functions. Mathematical Reviews

537.533.3

8828. AN OPTIMUM PARAMETER BETA-RAY SPECTROMETER. C.Geoffrion and G.Giroux..
Canad. J. Phys., Vol. 34, No. 9, 920-8 (Sept., 1956).

A semicircular spectrometer in which the various parameters of the apparatus have been given values such that the maximum intensity of a monoenergetic electron beam is as great as possible at a given resolution. The apparatus gives a spectrum automatically, measures beams with a limit of resolution reaching 0.07%, and can detect electrons of energy ranging between 0 and 4 MeV. A.

537.533.8

8829. SECONDARY ELECTRON EMISSION FROM THIN LAYERS OF SILVER. I.M.Bronshteĭn and T.A.Smorodina.
Zh. éksper. teor. Fiz., Vol. 29, No. 4(10), 500-6 (1955). In Russian. English translation in: Soviet Physics, JETP (New York), Vol. 2, No. 3, 414-19 (May, 1956).

The effects of the underlying surface on the emission depth of the secondary electrons are examined by the deposition of a layer of the metal on the target. A real emission depth of secondary electrons from silver is determined. It is shown that in the region of 100–600 eV the emission depth depends linearly on the energy of the primary electrons. It is established that, for adsorption of approximately monatomic layers of silver on nickel and beryllium, displacements of the maxima of the energy distribution curves of the secondary take place for increasing thickness. The maximum of the curve for Ag on Ni is displaced to the left and that for Ag on Be to the right. This fact points to an influence of the work function of the base on the energy distribution function of the secondary electrons. A.

537.533.92 : 537.534.9

8830. SIMULTANEOUS EXCITATION AND IONIZATION OF HELIUM BY ELECTRON AND PROTON IMPACT. A.Dalgarno and M.R.C.McDowell.
Airglow and the aurorae (Belfast) 340-5. See Abstr. 7088 (1956).

Using Born's approximation, cross-sections have been calculated for the processes $e + He \rightarrow e + He^+(nl) + e$ and $H^+ + He \rightarrow H^+ + He^+(nl) + e$ for nl, any of 2p, 3p, 4p, 3d and 4d. A.

537.534

8831. THE PROTON SYNCHROTRON. J.P.Blewett.
Rep. Progr. Phys., Vol. 19, 37-79 (1956).

Three proton synchrotrons are now in operation in the energy range above 1000 MeV (1 GeV). A 1 GeV machine has been constructed at the University of Birmingham and 3 and 6 GeV machines are located at the Brookhaven National Laboratory (N.Y., U.S.A.) and the Berkeley Radiation Laboratory (California). In this report a general description of these three synchrotrons is preceded by a brief presentation of the applicable proton dynamics. A survey is also included of the salient features of a 10 GeV air-cored proton synchrotron under construction at Canberra (Australia). The discovery of alternating-gradient focusing has made possible the design of proton synchrotrons in the 10 to 50 GeV range. The dynamics of protons in alternating-gradient fields are discussed and design data are presented for machines to be constructed by Brookhaven and by the European Organization for Nuclear Research in Geneva, Switzerland. A novel application of the new focusing method evolved by the Midwest Universities Research Association (U.S.A.) is also explained. A.

537.534.74

8832. INELASTIC COLLISIONS BETWEEN HEAVY PARTICLES. D.R.Bates and A.Dalgarno.
Airglow and the aurorae (Belfast) 328-36. See Abstr. 7088 (1956).

Studies on heavy-particle collisions which have appeared since the reviews of Massey and Burhop (Abstr. 4392/1952) and of Allison and Warshaw (Abstr. 6678/1954), are briefly summarized. A.

DISCHARGE TUBES. COUNTERS 537.54

537.542 : 539.155.1

TWIN-OVEN ELECTRON BOMBARDMENT ION SOURCE OR MASS-SPECTROMETER. See Abstr. 8334

537.542

33. TWO BETTER WAYS TO DETERMINE GEIGER–UELLER-TUBE AGE. J.S.Reddie and W.C.Roesch. ucleonics, Vol. 14, No. 7, 30-2 (July, 1956).

The threshold coefficient (change in threshold voltage per nfold increase in counting rate) and the amplitude coefficient bsolute value of the exponent in power law relating pulse ight to counting rate at a fixed voltage) both provide a linear easure of counter age. Their measurement is quicker than e conventional measurement of the plateau slope. Experi- ents showed that the changes in these coefficients were rela- d to changes in the electrodes, while degeneration of the nench gas caused increase of the threshold voltage without fecting the coefficients. R.D.Smith

537.542

334. TIME DELAYS IN BORON TRIFLUORIDE PROPOR- IONAL COUNTERS. K.P.Nicholson. roc. Phys. Soc. A, Vol. 69, Pt 5, 413-15 (May, 1956).

The time delays in BF_3 counters (used in neutron time-of- ight measurements) were measured with reference to a aI(Tl) scintillation counter, which gives no appreciable delay. elay time distributions for various discriminator levels are hown. The delays varied up to about 3 μsecs. J.D.Craggs

537.542

335. HIGH-EFFICIENCY SLOW-NEUTRON SCINTILLATION OUNTERS. K.H.SUN, P.R.Malmberg and F.A.Pecjak. ucleonics, Vol. 14, No. 7, 46-9 (July, 1956).

Full details are given for the preparation of scintillator sks containing B and ZnS(Ag). The ZnS(Ag) is suspended in BO_2 glass or a boron plastic formed by mixing boric acid id glycerol. The most sensitive disks contained two parts nS to one part plastic and were 1.2 mm thick. By grooving e surface of the disk facing the photomultiplier an overall fficiency of 33% for thermal neutrons was obtained with good scrimination against gamma-rays. R.D.Smith

537.542 : 519.2

836. STANDARD DEVIATION OF DEAD TIME CORRECT- ON IN COUNTERS. L.L.Campbell. anad. J. Phys., Vol. 34, No. 9, 929-37 (Sept., 1956).

Because of the finite recovery time of counters a correct- on must be applied to the number of registrations which the ounter makes so that a better approximation to the true rate it which events occur may be obtained. It is shown here that, or random events, the standard deviation of the corrected ate is approximately $[\nu(1 + \nu T/t]^{1/2}$, where ν is the mean ate at which events occur, T is the recovery time of the ounter, and t is the duration of the observation. This value of the standard deviation is an asymptotic value which holds or large values of t. As an intermediate result, an asymptot- ic expression is obtained for the value of the mth moment of he number of registrations in time t. The method used here ould also be applied to determine asymptotic expressions for he expected values of other functions of the number of regis- rations. A.

537.542 : 519.2

ON A PROBABILITY PROBLEM ARISING IN THE THE- ORY OF COUNTERS. See Abstr. 7934

537.542

837. A LOW PRESSURE DIFFUSION CHAMBER. A.P.Komar, M.V.Stabnikov and D.A.Yashin. Dokl. Akad. Nauk SSSR, Vol. 108, No. 1, 64-5 (1956). In Russian.

The successful construction and operation of the device is reported. The chamber has been designed to be used with strong magnetic fields in those cases where low energy heavy fragments from nuclear reactions would have too short a range in conventional diffusion chambers. The average working pressure of the air and methyl alcohol mixture is 30 mm Hg, the temperature gradient being 46° C (−4° C at the top and −50° C at the bottom). The pressure may be varied so as to allow good discrimination of low energy fragments having different ionizing power. A detailed sectional view and good photographs of various events are shown. G.Martelli

537.542

8838. PHOTOMETRIC IONIZATION MEASUREMENTS IN A MULTIPLATE CLOUD CHAMBER. D.O.Caldwell and Y.Pal. Rev. sci. Instrum., Vol. 27, No. 8, 633-8 (Aug., 1956).

A simple, projection type of photometer is used to measure the track opacity, from which the ionization of the track is obtained by comparison with the opacity of a track of known ionization. The ratio of the properly normalized opacities of the two tracks is related to the ratio of their ionizations by a simple power law. The technique has been employed, with geometric residual range determinations, to find particle masses. It also has been used, when the mass is known, to ascertain the residual range in the plate in which a particle stops. By determining both the ionization and the change in ionization occurring in a plate traversal, both the mass and the residual range of particles have been found. Specific applications include a determination of the range of the secondaries from $K_{\mu 2}$ and $K_{\pi 2}$ decays, and a measurement of the mass of a particle which releases more than 1.6 BeV on stopping. The latter is found to have a mass consistent with its being an antiproton. A.

537.543 : 621.385.23.029.6

8839. MOTION OF ELECTRONS IN THE DISCHARGE SPACE OF A DIODE WITH A RAPIDLY CHANGING ANODE VOLTAGE. N.I.Ivanov.
Radiotekhnika, Vol. 11, No. 1, 50-6 (1956). In Russian.

Plane electrodes are examined, the edge effects neglected, electrons have zero initial velocity and the emission is saturated, the interelectrode space is divided up into layers having equal space charge per unit area. A graphical method is introduced for solving the essential integral equation, and an example given of the calculation of the current waveform. S.C.Dunn

IONIZATION. THERMIONICS 537.56/58

537.562

8840. REFINED THEORY OF ION PAIRING. I. EQUILIBRIUM ASPECTS. H.Reiss.
J. chem. Phys., Vol. 25, No. 3, 400-7 (Sept., 1956).

This paper contains a detailed theory of ion pairing based on the viewpoint that the distribution of pairs is more fundamental than the density of ions in an ionic atmosphere. This distribution is then evaluated by considering the kinetic mechanism by means of which pairs exchange partners. The functions so derived, besides being applicable to nonequilibrium situations, are free of many of the inconsistencies which attend the simple theory of pairing based on mass action considerations. The present paper restricts attention to the properties at equilibrium. A.

537.562

8841. REFINED THEORY OF ION PAIRING. II. IRREVERSIBLE ASPECTS. H.Reiss.
J. chem. Phys., Vol. 25, No. 3, 408-13 (Sept., 1956).

This paper applies the nonequilibrium distribution function for ion pairs, derived in Pt I (see preceding abstract), to the

PA

case of ionic mobility in an external electric field. The results are in good agreement with the simple theory of Fuoss and demonstrate the virtue of the latter. A.

537.562

8842. ENERGY REQUIRED TO PRODUCE ONE ION PAIR IN SEVERAL NOBLE GASES. J.Weiss and W.Bernstein.
Phys. Rev., Vol. 103, No. 5, 1253 (Sept. 1, 1956).

The absolute values of W, the energy to produce one ion pair, for electrons have been determined for purified noble gases. A parallel plate extrapolation ionization chamber, which could be evacuated, was used. The gases investigated were H_2, He, Ne, A, Kr, and Xe; and the absolute values of W were 36.3; 40.3; 35.3; 25.8; 24.7; 22.0 eV respectively based on W for air being 33.9 eV. A.

537.562

8843. DENSITY EFFECT ON THE IONIZATION IN GASES BY ELECTRONS. W.C.Barber.
Phys. Rev., Vol. 103, No. 5, 1281-4 (Sept. 1, 1956).

The density effect on the ionization produced by electrons has been observed by comparing their specific ionization in He and H_2 gases at one and ten atmospheres pressure. The measurements were made by sending primary electrons of energy variable from 2-35 MeV through an ionization chamber into a Faraday cup. No density effect is observed or expected at one atmosphere pressure at these energies, but at ten atmospheres pressure, the results indicate the onset of the density effect at about 10 MeV in H_2 and 20 MeV in He. At 35 MeV, the percentage reduction in ionization from that expected without density effect amounts to (8.0 ± 1) in H_2 and (3.5 ± 1.3) in He. These results are in near agreement with the calculations of Sternheimer. A.

537.563 : 539.166.83

MULTIPLE IONIZATION IN XENON FOLLOWING INTERNAL CONVERSION. See Abstr. 8363

537.565

8844. MOBILITY AND SPACE CHARGE OF IONS IN A NON-UNIFORM FIELD. Yu.M.Kagan and V.I.Perel'.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 2, 222-5 (1956). In Russian.

The concentration of ions and mobility outside a charged layer are studied. For the case when space charge is formed from positive ions only the potential is found from Poisson's equation and the equations are solved. G.E.Brown

537.565

8845. ELECTRON ATTACHMENT IN SULFUR HEXAFLUORIDE. D.Berg and T.W.Dakin.
J. chem. Phys., Vol. 25, No. 1, 179 (July, 1956).

Considers that the lack of agreement between values of attachment coefficient measured by Reeves and Geballe (Phys. Rev., Vol. 96, No. 3, 862, Nov. 1, 1954) and those of McAfee (Abstr. 8876/1955) can be accounted for in terms of differences of electron energies in the experiments.
C.G.Morgan

537.568

8846. RECOMBINATION OF HYDROGEN ATOMS AT METAL SURFACES. K.G.Pickup and B.M.W.Trapnell.
J. chem. Phys., Vol. 25, No. 1, 182 (July, 1956).

The activities of a number of metals in catalysing the recombination of H atoms give a smooth curve when plotted against atomic number (Z). It is suggested that in catalysis the surface state of a metal may approximate to that of the free atoms (expressed through Z) rather than to that of the bulk metal (expressed through d-character). S.J.Gregg

537.572

8847. IONIZATION ON PLATINUM AND TUNGSTEN SURFACES. I. THE ALKALI METALS. S.Datz and E.H.Taylor.
J. chem. Phys., Vol. 25, No. 3, 389-94 (Sept., 1956).

The ionization of all of the alkali metals on tungsten and on tungsten oxide surfaces follows the Saha–Langmuir equation with no reflection. On platinum, however, a departure from this equation indicates partial reflection of the atoms. The reflection of Na is probably 0%, since the ionization efficiency is given closely by the Saha–Langmuir equation with a value of 5.50 eV for the work function of Pt at 2000°K. The same value of the work function then indicates reflections of 18% for Li, 48% for K, 22% for Rb and 8% for Cs, at 2000°K. A.

537.572

8848. IONIZATION ON PLATINUM AND TUNGSTEN SURFACES. II. THE POTASSIUM HALIDES. S.Datz and E.H.Taylor.
J. chem. Phys., Vol. 25, No. 3, 395-7 (Sept., 1956).

The ionization of the potassium halides on tungsten follows the Saha–Langmuir equation and indicates the formation of stable partial films of halide. On platinum, however, reflection occurs amounting to more than 99% for KCl, KBr and KI, and about 75% for KF. A.

537.581 : 537.311.33

8849. ON THERMIONIC EMISSION IN SEMICONDUCTORS. A.Bohun.
Czech. J. Phys., Vol. 6, No. 2, 198-9 (April, 1956). In German.

Preliminary report on observations of electron emission from Ge previously irradiated with soft (25 kV) X-rays. The Ge was either etched or lapped. It is concluded that the emission originates from an oxide layer on the surface, hence experiments on GeO_2 are proposed. T.P.Brody

COSMIC RAYS 537.591

537.591.1

8850. HEAVY PRIMARY COSMIC RADIATION AT THE EQUATOR. R.E.Danielson, P.S.Freier, J.E.Naugle and E.P.Ney.
Phys. Rev., Vol. 103, No. 4, 1075-81 (Aug. 15, 1956).

The zenith and azimuthal angular distribution of primary cosmic-rays with charges ≥ 6 has been measured at the equator using oriented nuclear emulsions. The magnitude of the azimuthal asymmetry is consistent with an integral power law spectrum which falls off inversely as the 2.0 power of the total energy per nucleon. However, the maximum intensity comes from the southwest rather than the west. This is consistent with the recently proposed shift of the earth's effective magnetic field for cosmic rays. The flux at the top of the atmosphere is 0.68 particle m^{-2} sec^{-1} $sterad^{-1}$ for carbon, nitrogen, oxygen and fluorine nuclei and 0.21 particle m^{-2} sec^{-1} $sterad^{-1}$ for nuclei with $Z \geq 10$. A.

537.591.1

8851. THE ATMOSPHERIC EFFECTS ON THE INTENSITY OF HIGH ENERGY μ-MESONS. T.Murayama, K.Murakami, R.Tanaka and S.Ogawa.
Progr. theor. Phys., Vol. 15, No. 5, 421-30 (May, 1956).

In order to reconsider the present model of the cosmic ray in the middle energy region, calculations are made for the atmospheric effects on the oblique intensity of high-energy μ-mesons under the following assumptions: (1) the μ-mesons are originated only through the decay of π-mesons; (2) the source function of these π-mesons decreases exponentially with an atmospheric depth. Zenithal dependence and the absolute intensity of the μ-mesons at sea level deduced theoretically are compared with a narrow-angle counter telescope experiment by Sekido, Yoshida and Kamiya. Satisfactory accordance seems to suggest the consistency of the present assumptions. Correlation coefficients of the temperature

ffect are also obtained on the oblique μ-mesons. It is shown hat the negative temperature effect can be mainly attributed) the variation of the height of μ-meson production, but is artly dependent on the variation of the density distribution of ne air. The correlation coefficients of the temperature ffects on the vertical μ-meson are also compared with the xperimental results of Duperier. A.

537.591.15

8852. MESON SHOWERS AND ACCOMPANYING DISINTEGRATIONS. J.Pernegr.
Czech. J. Phys., Vol. 6, No. 2, 194 (April, 1956).

Cosmic ray showers were studied in G5 emulsion exposed t balloon and mountain altitudes. 9 showers with $n_S \geq 5$ and $n_h \leq 3$ were found to be isotropic in the centre-of-mass system and to give values of inelasticity coefficient K varying rom 0.2 to 0.91, indicating predominantly multiple meson roduction processes above 10^{11}eV. 46 showers with $n_h > 4$ ave evidence of plural processes. Collimation of α-particles rom stars (with and without shower particles) was observed lso. A more detailed paper is to follow. R.H.W.Johnston

537.591.15 : 519.2

A MEASURE OF DISPERSION APPLIED TO COSMIC RAY AND OTHER PROBLEMS. See Abstr. 8548

537.591.5

8853. THE GEOMAGNETIC LATITUDE EFFECT ON THE NUCLEON AND MESON COMPONENT OF COSMIC RAYS AT SEA LEVEL. D.C.Rose and J.Katzman.
Canad. J. Phys., Vol. 34, No. 1, 1-19 (Jan., 1956).

Measurements have been taken on the changes in intensity of the nucleon and meson components of cosmic rays during a cruise of the Canadian Naval Icebreaker "Labrador" into the Arctic, through the North West Passage, and circumnavigating the North American Continent. The geomagnetic latitudes covered extend from 18°N to 89°N. The latitude knee is clearly shown at a geomagnetic latitude of about 52° in the case of the nucleon component and less definitely between 40° and 50° in the case of the meson component. The rigidity of particles arriving in a vertical direction at 52° is 2.1 BV and at 45° is 3.7 BV. Meyer and Simpson have shown that changes in the primary spectrum between 1948 and 1954 probably extend up to these rigidities and such changes should, therefore, be observable at sea level. The longitude effect at low latitudes is clearly shown by differences in intensity between the measurements on the east and west sides of North America. In the case of the meson component, the magnitude of the longitude effect at these longitudes was found to be greater than that shown by Millikan and Neher in 1936. The interpretation of the meson component results above the knee is complicated by difficulties in temperature correction. In the case of the nucleon component, an apparent longitude effect exists above the knee in that there was a small difference in the intensity at high latitudes in the eastern and western parts of the North American Arctic. No satisfactory explanation is offered for this. The diurnal variation of the nucleon component at high latitudes is shown but no unusual features were found. A.

537.591.5

8854. LATITUDE EFFECT OF THE COSMIC RAY NUCLEON AND MESON COMPONENTS AT SEA LEVEL FROM THE ARCTIC TO THE ANTARCTIC. D.C.Rose, K.B.Fenton, J.Katzman and J.A.Simpson.
Canad. J. Phys., Vol. 34, No. 9, 968-84 (Sept., 1956).

Results are presented of cosmic-ray measurements taken at sea level during 1954-55 from the Arctic to the Antarctic. The equipment consisted of a neutron monitor and a meson telescope. Latitude effects of 1.77 for the nucleonic component and 1.15 for the meson component were measured. The longitude effect at the equator was much less than expected on the basis of the geomagnetic eccentric dipole and the longitude effect at intermediate northern latitudes shows that the longitude of the effective eccentric dipole is considerably west of that of the geomagnetic eccentric dipole. In a previous paper by the same authors, the positions of the equatorial minima were combined with other published cosmic-ray measurements to calculate a new cosmic-ray geomagnetic equator. In this paper new coordinates are derived on the assumption that these equatorial coordinates apply to a new eccentric dipole, and, therefore, that the equatorial coordinates may be extended to high latitudes. When the complete results are plotted on these coordinates, it is found that an eccentric dipole representation of the earth's magnetic field is inconsistent with the combined observations at all latitudes. A.

537.591.5

8855. THE SUDDEN INCREASE IN COSMIC RAY INTENSITY OF FEBRUARY 23, 1956. D.C.Rose and J.Katzman.
Canad. J. Phys., Vol. 34, No. 8, 884-7 (Aug., 1956).

This was observed at Ottawa (lat. 45.5° N, long. 75.6° W, geom. lat. 56.8° N) by neutron monitors and with counter telescopes, and at Resolute (lat. 74.7° N, long. 94.9° W, geom. lat. 83.0° N) with a counter telescope. The nucleon component increase was found to be 28 times the normal rate compared with only a fractional increase of the normal meson component rate. The percentage increase as measured by counter trays varies appreciably with the amount of absorber. The time of onset of the increase may be earlier in the case of the nucleon component than in the meson component. Unlike the 1949 increase, the shape of the curve at Resolute is of the same general form as that at Ottawa. The increase occurred during considerable activity in intensity variations of the type usually associated with solar activity. E.W.Kellermann

537.591.5

8856. EXTRAORDINARY INCREASE OF COSMIC RAY INTENSITY. A.I.Kuz'min, G.V.Skrŷpin, G.V.Tyanutova and Yu.G.Shafer.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 1, 66-8 (1956). In Russian.

The phenomenon has been observed on 23rd February, 1956 in Jakutsk (101 m above sea level, geomagnetic latitude 51°, longitude E 129°). Starting at 0345 UT the intensity rapidly increased and then slowly returned to the pre-disturbance value after about six hours. The recordings of a 1000 litre ionization chamber filled with argon at 10 atm and shielded with 12 cm Pb show an increase of 200%. Directional telescopes of G.-M. counters registered an increase: (a) of 200% for the vertical component; (b) of 165% for the component coming from the south and forming an angle of 30° with the vertical; (c) of 190% for the component coming from the north and forming an angle of 30° with the vertical. During the same period the frequency of showers with average densities of 25 and 50 particles/m^2 did not vary appreciably, but a sudden increase of 10° C in the atmospheric temperature has been recorded at the height of 50 mbars. Total absorption of 2-7 Mc/s radiowaves occurred at 0400 UT. The average energy of the particles responsible for the variation has been evaluated 10^9-10^{10} eV. G.Martelli

537.591.5 : 523.72

8857. COSMIC -RAY INCREASE OBSERVED AT HIGH SOUTHERN LATITUDES ON FEBRUARY 23, 1956. A.G.Fenton, K.G.McCracken, N.R.Parsons and P.A.Trost.
Nature (London), Vol. 177, 1173-4 (June 23, 1956).

This was observed at Hobart (Geomag. co-ord. 52°S., 224°E) by means of an ion chamber commencing at 0341 ± 2 min G.M.T., and vertical and inclined telescopes, and at Macquarie Island (61°S, 243°E) and Mawson (73°S., 103°E) by telescopes. The lead shielding was 10 cm, with an additional layer available at the second station. From the timing with reference to the accompanying fade-out it is concluded that the path length of the particles cannot have been more than $1\frac{1}{2}$ times the sun—earth distance. The effect was more pronounced at low particle-energy. The increases observed at the latter

two stations are held not to be consistent with the impact zones predicted on the basis of a simple dipole field. For a period of a few days after the increase the intensity was about two percent less than normal. E.W.Kellermann

537.591.5 : 523.72

THE SOLAR OUTBURST, 23 FEBRUARY 1956. See Abstr. 8557

MAGNETISM 538

538.11

8858. THE DE HAAS–VAN ALPHEN EFFECT IN THIN METAL LAYERS. A.M.Kosevich and I.M.Lifshits.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 743-7 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 646-9 (July, 1956).

The magnetic properties of electrons in thin metal layers are discussed for an arbitrary law of dispersion. The energy levels of quasi-particles with an arbitrary law of dispersion in a magnetic field in the presence of a transverse potential field are determined. The oscillating part of the magnetic moment of a gas of such quasi-particles is calculated and general formulae are used for investigating the de Haas–van Alphen effect in thin metal layers. It is shown that the periods and amplitudes of the oscillations are determined by the form of the limiting Fermi surface and depend appreciably on the ratio of the thickness of the layer to the "radius of the classical orbits" of the quasi-particles. A.

538.112

8859. MAGNETIC PROPERTIES OF TRIVALENT IONS OF EUROPIUM AND SAMARIUM. A.S.Borovik-Romanov and N.M.Kreĭnes.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 790-7 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 657-63 (July, 1956).

The magnetic susceptibilities of Eu_2O_3, Sm_2O_3 (in two crystalline modifications) and $Sm_2(C_2O_4)_3.10\,H_2O$ have been measured from 12 to 300° K. A strong dependence of the magnetic properties of the samarium ion on the crystalline structure of the compound in which it occurs was found. With a decrease in the effect of the crystalline field, the experimental curves of the temperature dependence of the magnetic susceptibility approximate the theoretical curve of Van Vleck for free ions. An apparatus for measuring magnetic susceptibility over a wide temperature interval is described. A.

538.114

8860. METHOD OF CALCULATING OF STATISTICAL SUMS FOR [THE EXCHANGE PROBLEM IN] FERROMAGNETICS TAKING INTO ACCOUNT THE RESTRICTIONS OF SPIN WAVE OCCUPATION NUMBERS. V.V.Tolmachev and S.V.Tyablikov.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 6, 1029-31 (1956). In Russian.

The Bloch spin wave treatment (Z. Phys., Vol. 61, 206, 1930). of the ferromagnetic exchange problem neglects a summation over nearest-neighbour pairs of atoms; this is justified only at low temperatures where ferromagnetic ordering occurs. The authors present a method of (formally) carrying out the required summation and show that their result reduces to that of Bloch in the low temperature limit. J.W.Gardner

538.2 : 621.318.12

8861. MAGNETIC SPECTRA. J.B.Birks.
Proc. Instn Elect. Engrs, Paper 2217 R, publ. Oct., 1956, 10 pp. To be republished in Vol. 104 B (1957).

The various types of magnetic spectra are reviewed. In ferromagnetic metals, relaxations of various time-constants occur. Above 200 Mc/s, the magnetic dispersion is attributable to incomplete penetration of surface domains, due to skin effect, and internal phenomena are not observed. In low-conductivity paramagnetic materials, three types of relaxation have been found, namely spin-lattice, spin-spin, and a third, yet to be identified. The application of a static magnetic field normal to the h.f. field causes electron-spin resonance absorption at the Larmor precession frequency. This induced resonance, which has been observed in paramagnetic materials, in ferromagnetic metals and in ferrites, is broadened by relaxation effects. Similar induced nuclear magnetic resonance is found at lower frequencies. The magnetic spectra of the ferrites exhibit similar natural resonances in the absence of an applied static field. These resonances, which occur in both the microwave and r.f. regions, are due to domain spin rotations in the internal anisotropy field, and to domain wall displacements, and their identity is discussed. Magnetic dispersion due to relaxation of translational and other magnetization processes occurs at r.f. and lower frequencies. The relaxation of irreversible magnetization processes also occurs in the l.f. region. A.

538.22

8862. THEORY OF MAGNETIC SUSCEPTIBILITY OF METALS AT LOW TEMPERATURES. I.M.Lifshits and A.M.Kosevich.
Zh. éksper. teor. Fiz., Vol. 29, No. 6 (12), 730-42 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 636-45 (July, 1956).

The magnetic properties of electrons in a metal are investigated for the case of an arbitrary dispersion law. The energy levels are found for a quasi-particle under an arbitrary dispersion law in a magnetic field, and the magnetic moment of a gas of such quasi-particles is computed, spin paramagnetism being taken into account. It is shown that the periods and amplitudes of the oscillations are determined by the form of the Fermi boundary surface. Knowledge of these quantities permits one to reconstruct the form of the Fermi surface and the values of the velocities on it. A.

538.221

8863. CONCERNING THE EXISTENCE OF A NEGATIVE BARKHAUSEN EFFECT. J.Fischer.
Czech. J. Phys., Vol. 6, No. 1, 65-73 (Jan., 1956). In Russian, with summary (1 p.) in English.

Kirenskiĭ and Ivlev (Abstr. 3642/1951) published results showing a negative Barkhausen effect in an annealed specimen of Ni wire. The present author has investigated some 45 specimens of iron, nickel and sundry alloys and found no evidence of a negative Barkhausen effect. An experiment with a specimen very like that used by Kirenskiĭ and Ivlev also failed to disclose the negative effect. It is suggested that the results found by Kirenskiĭ and Ivlev were due to distortions produced by the a.c. amplifier they used. In the author's experiment a d.c. amplifier was employed. C.R.S.Manders

538.221 : 538.69

8864. EFFECT OF MAGNETIC FIELD STRENGTH DURING CONDENSATION ON THE COERCIVITY AND FORM OF VAPOR-DEPOSITED IRON. A.J.Griest, J.F.Libsch and G.P.Conard.
J. appl. Phys., Vol. 27, No. 9, 1022-4 (Sept., 1956).

The coercivity and form of iron deposited from the vapour were found to be influenced by the strength of a magnetic field applied during condensation. The intrinsic coercivities of powders deposited at −196° C and at −78° C in fields of 800 to 900 oersteds were about 120 oersteds. The greater fraction of particle diameters ranged from 10 to 20μ. No appreciable quantity of submicron particles was detected in several samples examined by electron microscopy. Line-broadening in the diffraction patterns of the vapour-deposited iron was attributed to strain, the magnitude of which was theoretically sufficient to account for the observed coercivities. A.

538.221

8865. INVESTIGATIONS ON BARIUM FERRITE MAGNETS. K.J.Sixtus, K.J.Kronenberg and R.K.Tenzer.
J. appl. Phys., Vol. 27, No. 9, 1051-7 (Sept., 1956).

Barium ferrite ($BaO:6Fe_2O_3$) has been investigated magnetically to test the predictions of fine particle theory in the region of grain sizes larger than the critical one for which no satisfactory theory exists as yet. Grain size and coercive force of polycrystalline magnets (nonoriented and crystal oriented) were closely related to sintering temperatures. A comparison of theoretical and observed temperature dependence of coercive force is made and shows a close fit when certain reasonable assumptions are made. Susceptibilities showed values attributed to rotation of the magnetization vector for samples of high coercive force only (4000 Oe), while wall movements contribute more or less to the susceptibility of all other samples. Domain patterns show wall movements in applied fields on samples with particle thickness down to 10×10^{-4} cm. Patterns on grains below 5×10^{-4} cm thickness ($_IH_C$ more than 2000 Oe) indicate reversals of magnetization by the rotation process. On magnets of the transition particle size both processes can be observed side by side, the walls being less movable for higher coercive forces. A.

538.221

8866. MOTION OF FERROMAGNETIC DOMAIN WALLS IN 48 Ni–Fe TAPES. R.W.Cole.
J. appl. Phys., Vol. 27, No. 9, 1104 (Sept., 1956).

Reports results of Sixtus–Tonks type experiments on cold-rolled and annealed strips under tension, and draws conclusions as to the shape of the wall. Critical field values H_0 obtained are about 4-6 oersted for cold-rolled and 0.3-0.5 oersted for annealed specimens. E.P.Wohlfarth

538.221

8867. INFLUENCE OF MAGNETIC FIELD ON THE PRECIPITATION PROCESS OF FERROMAGNETIC PHASE IN Cu–Fe ALLOY. I. T.Mitui.
J. Phys. Soc. Japan, Vol. 11, No. 8, 895-6 (Aug., 1956).

Reports results of magnetic torque and Vickers hardness measurements on an alloy containing 2% Fe. The dependence of the anisotropy and hardness on the duration of heat treatment was determined, and it is concluded that the precipitates are initially non-ferromagnetic and only transform to a ferromagnetic phase after about 5 hours at 700°C.

E.P.Wohlfarth

538.221 : 538.632

8868. THE THEORY OF THE HALL EFFECT OF FERROMAGNETIC ALLOYS. K.Meyer.
Z. Naturforsch., Vol. 10a, No. 8, 656-7 (Aug., 1955). In German.

The ordinary Hall coefficient R_0 of Cu–Ni alloys varies slightly with temperature. This effect is shown to be explicable on the basis of Vonsovsky's theory of ferromagnetism.

E.P.Wohlfarth

538.221

8869. METHOD OF DETERMINATION OF PARAMETERS OF FERROMAGNETIC RESONANCE FROM EXPERIMENTAL DATA. A.I.Pil'shchikov.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 798-807 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 703-10 (July, 1956).

A calculation of the conditions for the extrema of the magnetic permeabilities in the region of ferromagnetic resonance is carried out. On the basis of the results obtained, formulae are derived for the determination of the gyromagnetic ratio and the relaxation time from experimental data. In the proposed method the calculation of the parameters of ferromagnetic resonance is carried out for fields of magnitudes corresponding to extrema of the magnetic permeabilities. Consequently, the necessity of calculating the maximum value of the magnetic permeability μ_k (or ρ'), which is the source of a large error (greater than 25%) in the determination of the relaxation time, disappears. It is shown that the method of calculation of g and T for fields of the extrema is applicable in cases where it is impossible to calculate the maximum values of the permeability μ_k (or ρ'). A.

538.222

8870. PARAMAGNETIC RESONANCE OF EUROPIUM AND OF GADOLINIUM IN FLUORITES. C.Ryter and R.Lacroix.
C.R. Acad. Sci. (Paris), Vol. 242, No. 24, 2812-14 (June 11, 1956). In French.

Measurements have been carried out in a magnetic field of frequency 9245 Mc/s on a single crystal of natural fluorite (CaF_2) in which Eu^{++} and Gd^{+++} appear as impurities.

G.I.W.Llewelyn

538.222

8871. EFFECTS OF TEMPERATURE ON THE ELECTRONIC PARAMAGNETIC RESONANCE OF COALS AND CHAR-COALS (CHARBONS). J.Uebersfeld and E.Erb.
C.R. Acad. Sci. (Paris), Vol. 242, No. 26, 3050-1 (June 25, 1956). In French.

The paramagnetic resonance of Donetz anthracite and of sugar charcoal have been measured at temperatures of 78°K, 200°K and 300°K. G.I.W.Llewelyn

538.222

8872. MAGNETIC RESONANCE ABSORPTION CAUSED BY ADDITIONAL PARAMAGNETIC IMPURITIES IN ALKALI HALIDES. H.Abe, H.Nagano, M.Nagusa and K.Oshima.
J. chem. Phys., Vol. 25, No. 2, 378-9 (Aug., 1956).

The effect of Cu, Fe, Mn added as impurities to Na and K halides in the polycrystalline state has been investigated. Results are tabulated and briefly discussed. G.I.W.Llewelyn

538.222 : 539.152.2

8873. OBSERVATION OF NUCLEAR MAGNETIC RESONANCES VIA THE ELECTRON SPIN RESONANCE LINE. G.Feher.
Phys. Rev., Vol. 103, No. 3, 834-5 (Aug. 1, 1956).

Irradiation of P-doped Si with the P nuclear magnetic resonance frequency, 53.0 Mc/s with H = 3133.85 Oe at 1.25°K enhances the electron resonance signal simultaneously observed at 8824.02 Mc/s as a result of the disturbance of the nuclear orientation populations. From the difference in the two r.f. frequencies, 11.59 ± 0.02 Mc/s, which correspond to nuclear transitions in the $m_J = +1/2$ and in the $m_J = -1/2$ states, the nuclear g_I value is found to be 2.265 ± 0.004; a knowledge of the electronic wave-function is not required in the derivation. For Li doped Si nuclear transitions at 4.89 and 5.74 Mc/s could similarly be detected at 3217 Oe. These indicated the unresolved structure from the coupling aI.J to have $a = 0.85 \pm 0.01$ Mc/s. D.H.Whiffen

538.222 : 539.219

THE MOMENTS OF THE PARAMAGNETIC RESONANCE ABSORPTION IN SOLID SOLUTIONS. See Abstr. 8986

538.24 : 621.372.011

8874. REPRESENTATION OF NONLINEAR CHARACTERISTICS BY LINEAR ELEMENTS. M.S.M.Abou-Hussein.
Trans Amer. Inst. Elect. Engrs I, Vol. 75, 84-6 (1956) = Commun. and Electronics, No. 23 (March, 1956).

Description of simple circuits (with compensated transformers) for the analogue solutions of Fröhlich and Emery equations of magnetization. R.Syski

ELECTROMAGNETISM. ELECTRODYNAMICS 538.3/.5

538.3 : 532.51

FLOW OF CONDUCTING FLUIDS IN PIPES UNDER A TRANSVERSE FIELD. See Abstr. 8613-14

538.52 : 550.837.6

ELECTROMAGNETIC INDUCTION IN A TWO-LAYER EARTH. See Abstr. 9056

ELECTROMAGNETIC WAVES AND OSCILLATORS 538.56

538.56

8875. PERTURBATION OF AN ELECTROMAGNETIC FIELD BY SMALL DEFORMATIONS OF A METAL SURFACE. B.Z.Kachenelenbaum.
Zh. tekh. Fiz., Vol. 25, No. 3, 546-57 (1955). In Russian.

A calculation of the first-order effect of slight deformations of a perfectly conducting plane on the electric and magnetic fields. It is shown that these deformations can be replaced by a charge and current distribution on the original plane boundary, and the radiation field of these charges and currents is then calculated. The results are applied to the problem of diffraction by a step whose height is small compared to a wave length. A comparison is made between the present method, and that of Rayleigh, as applied to the problem of scattering by a rough surface. Mathematical Reviews

538.566 : 621.396.11

8876. MICROWAVE OPTICS.
I. REPORT ON MICROWAVE OPTICS. R.C.Spencer;
II. DIFFRACTION PROBLEMS OF MICROWAVE OPTICS. H.Bremmer;
III. RECENT RESEARCHES ON THE FOUNDATIONS OF GEOMETRIC OPTICS AND RELATED INVESTIGATIONS IN ELECTRO-MAGNETIC THEORY. E.Wolf.
I.R.E. Trans Antennas and Propagation, Vol. AP-3, No. 4, 220-1, 222-8, 228-32 (Oct., 1955).

An account is given of the past sessions on microwave optics and the progress in organizing the correlation of work in this and related fields. Diffraction problems for which solutions are known are detailed and an extensive list of references given to original sources. The foundations of geometric optics are considered, and the deficiencies of present theories noted. Pulse solutions of Maxwell's equations throw light upon the nature of geometric optics. Analogues are drawn between geometric optics and rigorous electromagnetic theory.
W.T.Blackband

538.566 : 534.2

8877. FIRST CORRECTION TO THE GEOMETRIC-OPTICS SCATTERING CROSS SECTION FROM CYLINDERS AND SPHERES. S.I.Rubinow and T.T.Wu.
J. appl. Phys., Vol. 27, No. 9, 1032-9 (Sept., 1956).

The total scattering cross-section in the short wavelength limit is considered. The problems treated include diffraction of a plane electromagnetic wave by a conducting cylinder (two possible polarizations) or a conducting sphere, acoustic scattering by a rigid sphere, and quantum-mechanical scattering by an impenetrable sphere. The first correction term to the geometric-optics result is computed. In each case, this term is proportional to $(ka)^{-2/3}$. The constant of proportionality depends on the specific geometry. A.

538.566

8878. SCATTERING OF ELECTROMAGNETIC WAVES FROM A RANDOM SURFACE. W.C.Hoffman.
Quart. appl. Math., Vol. 13, No. 3, 291-304 (Oct., 1955).

Suppose $Z(x, y)$ is a real random process, continuous in the mean over a finite region D, and with mean value zero and covariance function $r(x, y; x', y')$. As such $Z(x, y)$ defines a random surface (provided certain differentiability conditions are satisfied). Then, by Karhunen's theorem on the representation of a random function, $Z(x, y)$ has an expansion in terms of an orthogonal process and the eigenfunctions and eigenvalues of the covariance function. Introducing this expression into the far-zone form of the Stratton–Chu solution of the electromagnetic field equations then leads to an approximate expression for the radiation scattered from the random surface, from which mean and covariance of the scattered field can be determined. A.

538.566

8879. SCATTERING BY A SEMI-INFINITE RESISTIVE STRIP OF DOMINANT-MODE PROPAGATION IN AN INFINITE RECTANGULAR WAVE-GUIDE. V.M.Papadopoulos.
Proc. Cambridge Phil. Soc., Vol. 52, Pt 3, 553-63 (1956).

The scattering of the dominant transverse electric mode in an infinite perfectly conducting rectangular waveguide by a semi-infinite resistive strip, centrally placed and parallel to the electric field, is calculated by the use of Laplace transforms. Formulae are derived for the amplitude of the scattered waves, and the numerical results, obtained using a digital computer, are given for various values of the surface resistivity of the strip. A.

538.566 : 621.372.833.1

8880. ON THE EXCITATION OF NON-IDEAL RADIO WAVE-GUIDES. V.A.Il'in.
Dokl. Akad. Nauk SSSR, Vol. 98, No. 6, 925-8 (1954). In Russian.

The theory of cylindrical guides is extended in two directions: (i) the material of the guide is to be of good but not ideal conductivity, (ii) the cross-sectional curve may have angular points. For (i) an approximate expression for the potential is found in terms of wave-functions for the ideal case, taken as far as the first and second powers of k/k_0, the ratio of the wave numbers of the two media. Mathematical Reviews

538.566 : 621.396.67 : 621.372.413

8881. ON THE THEORY OF THIN AERIALS IN RESONANT CAVITIES. A.V.Gaponov and M.L.Levin.
Dokl. Akad. Nauk SSSR, Vol. 95, No. 6, 1193-6 (1954). In Russian.

Oscillations on a number of aerials are discussed, when there is interaction because of immersion in the same cavity. The interaction is small when the aerials are thin and hence a perturbation method is used. Mathematical Reviews

538.566 : 621.396.67

8882. REFLECTION OF ELECTROMAGNETIC WAVES FROM THIN METAL STRIPS (PASSIVE ANTENNAE). K.Lindroth.
K. tekn. Högsk. Handl., No. 91, 60 pp. (1955).

The current induced in a thin metal strip by an incident wave is determined, and from this the re-radiation is calculated. Methods published by Hallén and van Vleck are compared. Both these solutions involve the first two terms of a power series. A method of calculating a third term is developed. The improvement introduced by consideration of the third term is more marked the thicker the strip. Curves show the change in re-radiation with frequency calculated by both the method of van Vleck and the three-term method.
W.T.Blackband

538.566.2 : 551.593 : 551.596

THE PROPAGATION OF WAVES IN A MEDIUM WITH RANDOM NON-UNIFORMITIES OF REFRACTIVE INDEX. See Abstr. 8532

538.566.3 : 621.396.11

8883. IONOSPHERIC ABSORPTION MEASUREMENTS AT THE K.N.M.I. (KONINKLIJK NEDERLANDS METEOROLOGISCH INSTITUUT). C.J.van Daatselaar.
T. Ned. Radiogenoot., Vol. 21, No. 2, 49-63 (March, 1956). In Dutch.

Deals with the measurements carried out at the Royal Netherlands Meteorological Institute, De Bilt, since 1955. A brief outline is given of the theory of ionospheric absorption

and its practical application and the following items are treated in more detail: (1) The techniques used in routine absorption measurements at De Bilt. (2) The influence of ground reflection coefficient, short- and long-period fading, polarization effects and selective absorption. (3) The method of determining the absorption index A and the experimental results obtained at De Bilt. (4) A full description of the transmitter and the receiver used in the measurements. A.

538.566.3

8884. ON THE EFFECT OF RADIO WAVES ON THE PLASMA (IONOSPHERE). A.V.Gurevich.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1112-24 (1956). In Russian.

A consistent method for determining the electron velocity distrubution function for a plasma in the presence of an alternating electric and constant magnetic field has been developed on the assumption of elastic collisions between the electrons on the one hand and molecules and ions on the other. Expressions for the mean electron energy, for the conductivity and dielectric constant of the plasma and for the effective number of electron collisions have been obtained. A.

538.566.3 : 551.510.535 : 535.42

SOME ASPECTS OF DIFFRACTION THEORY AND THEIR APPLICATIONS TO THE IONOSPHERE. See Abstr. 8710

538.569 : 536.6 : 621.317.784.029.6

8885. A MICROWAVE THERMISTOR CALORIMETER. M.J.Smith and J.R.M.Vaughan.
J. sci. Instrum., Vol. 33, No. 9, 353-6 (Sept., 1956).

The instrument described is an improved continuous-flow water calorimeter for the measurement of microwave powers from a few milliwatts upwards. Thermistors are used to measure the temperature rise of the water; their small size and high sensitivity allows the calorimeter to be relatively rugged, accurate and quick reading. The circuit is a direct reading d.c. bridge, indicating on a microammeter specially calibrated in degrees of temperature rise, and in watts of microwave power at a standard water flow rate. A mathematical analysis is given of the four-thermistor bridge, the compensation for variations of ambient temperature, and the correction for internal heat losses. Details are given of the practical method of setting the calibration and determining the cooling correction. Accuracy is thought to be better than ±10% for powers over 1 W at 8-9 mm wavelength, with a reading time of a few seconds. A.

538.569 : 523.72

8886. ELECTROMAGNETIC RADIATION FROM ELECTRON PLASMA. S.Hayakawa and N.Hokkyo.
Progr. theor. Phys., Vol. 15, No. 3, 193-202 (March, 1956).

Theory of plasma oscillation developed by Bohm and Pines is extended to involve the coupling between longitudinal and transverse oscillations. The coupling arises from the quantum fluctuation of electrons interacting with electromagnetic field. The coupling energy is found to be $\hbar kv$ approximately, where $\hbar k$ represents the recoil momentum of an electron due to the absorption (emission) of a longitudinal quantum with wave number k and v the velocity of the electron. This coupling may account for the solar outburst of radio waves, if the plasma is excited in a stream of electrons injected into the corona with high velocity. A.

MOLECULAR AND ATOMIC STRUCTURE 539.1

THEORY OF SOLID STATE 539.11

539.11 : 548.7

8887. THE QUANTUM MECHANICAL CALCULATION OF THE SURFACE ENERGY OF SODIUM CHLORIDE — A FIRST APPROXIMATION. F.van Zeggeren and G.C.Benson.
Canad. J. Phys., Vol. 34, No. 9, 985-92 (Sept., 1956).

Löwdin's theory for the cohesive energy of alkali halides has been used to calculate a first approximation to the surface energy of a {100} face of sodium chloride. The value found, 187 ergs/cm^2, differs from the experimental value determined by measuring heats of solution (276 ergs/cm^2) but is about 18% higher than the figure obtained from a corresponding classical model. For comparison the surface energies of several other alkali halides have been computed. A.

539.11

8888. ELECTRONIC ENERGY BANDS IN POTASSIUM. J.Callaway.
Phys. Rev., Vol. 103, No. 5, 1219-27 (Sept. 1, 1956).

The orthogonalized plane-wave method and the cellular method were applied to a calculation of electronic energy levels in potassium, using a potential obtained from a self-consistent field. The energies of twenty-four states at four symmetry points in the Brillouin zone have been obtained. The lowest band has been studied in detail and the qualitative features of the density of states were determined. Departures of the lowest band from free-electron behaviour were found. A comparison of higher bands with the results of some other calculations suggests that certain features of band schemes may be reasonably independent of the potential used. A.

539.11

8889. THE EFFECT OF THE MIXING OF π- AND σ-ORBITALS ON THE FERMI SURFACE IN THE L.C.A.O. MODEL FOR GRAPHITE. D.F.Johnston.
Proc. Roy. Soc. A, Vol. 237, No. 1208, 48-54 (1956).

The common energy of the two principal conduction bands in graphite along the triad axes in k-space is recalculated using an l.c.a.o. model based on sixteen orbitals per unit cell; four 2s and 2p (π and σ) orbitals centred on each of the four atomic sites in the unit cell. (An earlier calculation took account only of the four $2p_z$ orbitals.) The results of a group-theoretical analysis are used to show that only 15 of the 136 elements of the resulting 16 x 16 secular determinant are required to compute the doubly degenerate root corresponding to the common energy of the two conduction bands on the triad axes. This energy is found to vary periodically along the triad axes with an amplitude of 0.013 eV. The corresponding overlap of the two conduction bands is about three times larger than the overlap found in the earlier calculation. The resulting correction to the energy surfaces near the triad axes is too small to affect the calculation of the Hall coefficient of graphite for room temperatures based on the earlier calculation, but it is significant at low temperatures. For temperatures below about 50°K and in the absence of electron donors or traps, the conduction region in k-space is confined to the top of the lower conduction band where the density of states per unit energy range is estimated to be $1.1 \times 10^{-2} \sqrt{(0.0135 - \epsilon)}$ electronic states per atom per electron volt, and to the bottom of the upper conduction band where the density of states is found to be $5.8 \times 10^{-2} \sqrt{\epsilon}$. Formulae are given for the shape of the energy surfaces in these regions. A.

539.11

8890. COULOMB INTERACTIONS AND THE DIAMAGNETISM OF FREE ELECTRONS. H.Kanazawa.
Progr. theor. Phys, Vol. 15, No. 3, 273-93 (March, 1956).

The effect of the long-range part of Coulomb interactions on Landau diamagnetism is investigated, applying the collective description of Coulomb interactions developed by Bohm and Pines. It is shown that the magnitude of the diamagnetic susceptibility slightly increases due to the Coulomb interactions between electrons. A.

539.11 : 548.7

8891. ENERGY SPECTRUM OF AN ELECTRON IN A CRYSTAL IN A MAGNETIC FIELD. G.E.Zil'berman.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1092-7 (1956). In Russian.

It is shown that the discrete electron energy levels in strong magnetic fields, in a crystal, broaden out into narrow bands. The structure of the energy zone in a crystal located in a magnetic field is investigated. The possible effect of broadening on the De Haas–van Alphen effect is discussed. A.

539.11 : 535.43

SCATTER FORMULAE OF THE QUANTUM OPTICS OF METALS FOR THE INFRARED SPECTRUM REGION IN MULTI-ELECTRON THEORY. See Abstr. 8135

539.11 : 530.145

QUANTUM STATISTICAL MECHANICS OF ELECTRON-PHONON SYSTEM. See Abstr. 8300

MOLECULES 539.13

539.132

8892. NEW TERMS IN THE POTENTIAL FUNCTION OF THE Y_2X_2 MOLECULE. F.L.Keller, A.H.Nielsen and W.H.Shaffer.
J. chem Phys., Vol. 25, No. 1, 175-6 (July, 1956).

In the potential function for a linear Y_2X_2 molecule several cubic and quartic terms had been omitted by Shaffer and Nielsen (J. chem Phys., Vol. 2, 847, 1941). These depend on the phase angle between degenerate vibrations of A_{1g} symmetry. A new constant appears which affects the agreement between theory and experiment. J.Jacobs

539.132

8893. CONTRIBUTION TO THE STUDY OF THE VIBRATION–ROTATION SPECTRUM OF NITROGEN OXIDE. M.L.Grenier-Besson.
Cahiers de Phys., No. 68, 5-47 (1956). In French.

The quantum mechanical calculations by H.H.Nielsen from which the vibration–rotation energy levels are obtained to the 2nd order are here applied to N_2O. These calculations take into account in particular the anharmonic resonance interactions of 1st order. In order to determine a sufficient number of vibrational constants, taking account of the above interaction, experimental observations were made at 1.5 to 4.5 μ and at 300°C. The subsequent calculations of resonance multiplets agree with experimental results. Some vibration–rotation bands were also studied and some rotational constants were determined. J.Jacobs

539.132

8894. INTERNAL BARRIER IN CH_3CH_2F AND CH_3CHF_2 FROM TORSIONAL SATELLITES. D.R.Herschbach.
J. chem. Phys., Vol. 25, No. 2, 358-9 (Aug., 1956).

Barrier heights of 3300 cal. for CH_3CH_2F and 3180 cal. for CH_3CHF_2 are obtained from the observed splitting of the torsional states in the microwave spectrum of each molecule. The splitting decreases rapidly with increasing barrier height and the method was previously limited to barriers of 1800 cal. To obtain an observable magnification the spectra of the molecules in the first excited state are studied. G.Allen

539.132

8895. CALCULATION OF VIBRATIONAL RELAXATION TIMES OF THE CHLOROMETHANES. F.I.Tanczos.
J. chem. Phys., Vol. 25, No. 3, 439-47 (Sept., 1956).

The Schwartz, Slawsky and Herzfeld method for the calculation of vibrational relaxation times of gases has been extended in its application to polyatomic molecules. A general method is developed for the calculation of the effective relaxation times and the associated constants of the sound velocity relaxation equation. Calculations have been made for the bimolecular collisions of methane and the chloromethanes involving changes of one, two and three quanta. A normal coordinate treatment is used to obtain the atomic vibrational amplitudes. The effect of an intermolecular potential function, embodying a dipole interaction term, is included for the polar molecules of this investigation. Calculated results are compared with experimental data. For CH_4 and CH_3Cl the calculations agree well with experimental results. For CH_2Cl_2, $CHCl_3$ and CCl_4 the calculated relaxation times are higher than selected experimental values by factors of 8-9. For CH_2Cl_2, $CHCl_3$ and CCl_4 two major relaxation times are calculated. In the case of CH_2Cl_2 the two relaxation areas have been observed. The experimental data on $CHCl_3$ and CCl_4 remain inconclusive in respect to the two predicted relaxation areas. Collisions involving three quanta are shown to be important for CH_2Cl_2, $CHCl_3$ and CCl_4. A.

539.132 : 535.343

8896. VIBRATIONAL ASSIGNMENT IN MONOMERIC FORMIC ACID. J.K.Wilmshurst.
J. chem. Phys., Vol. 25, No. 3, 478-80 (Sept., 1956).

The infrared spectrum of formic acid vapour at 150°C has been studied over the 1800-1250 cm^{-1} region. A vibrational assignment has been made for monomeric formic acid and the anomalous frequency shifts in the three deuterated isotopic acids explained on this assignment by considering vibrational interaction. A.

539.132 : 535.343

8897. LOW-FREQUENCY LIBRATIONS AND THE VIBRATIONAL SPECTRA OF MOLECULAR CRYSTALS. R.M.Hexter and D.A.Dows.
J. chem. Phys., Vol. 25, No. 3, 504-9 (Sept., 1956).

The effect of librations of molecules about axes perpendicular to those of the transition moments of molecular vibrations upon the dichroic ratios associated with such vibrations in the infrared spectra of molecular crystals is considered. It is demonstrated that if such librations are harmonic and of small amplitude, the root-mean-square deviation of the molecular orientation from its equilibrium orientation is sufficient to account for the deviation of observed dichroic ratios from those predicted by the "oriented gas model". Deviations of this type previously reported from the polarized infrared spectra of iodoform, brucite, para-dichloro-benzene and benzene are reviewed. From a knowledge of the libration frequencies determined by examination of infrared or Raman spectra of molecular crystals, and of the observed dichroic ratios of polarized infrared spectra, the orientations of molecules and/or functional groups of molecules in crystals may be quantitatively determined. It is also demonstrated that as a consequence of the model used for correction of observed dichroic ratios, a branch-type libration-vibration spectrum of such crystals is predicted. The fine structure of this spectrum is discussed and is shown to be similar, in many ways, to the rotation-vibration spectra of polyatomic gases. The relationship of this work to the interpretation of electron density maps of molecular crystals is discussed. A.

539.132 : 535.333

VIBRATIONS OF THE BiO MOLECULE. See Abstr. 8656

539.132 : 535.343

STRETCHING MOTION IN $HgCl_2$ AND $HgBr_2$ MOLECULES. See Abstr. 8673

539.132 : 535.343

LATTICE VIBRATIONS IN GYPSUM CRYSTALS. See Abstr. 8896

539.132

8898. CLASSIFICATION OF π-ELECTRON STATES. W.T.Simpson.
J. Amer. Chem. Soc., Vol. 78, No. 15, 3585-90 (Aug. 5, 1956).

A classification of π-electron states is proposed in which two types are distinguished. The first type is described as in-

volving resonance among normal structures. Empirical justification may be found in the spectra of dyes, radicals and aromatic hydrocarbons. The second is described as involving resonance among excited structures. States of this type are reached in transitions in the carotenoid pigments. The spectra of benzene, azulene and naphthalene are examined and the various states classified as belonging to one or the other of the two types under consideration. A.

539.132

8899. REMARKS ON RADIATIONLESS TRANSITIONS IN COMPLEX MOLECULES. J.Franck and H.Sponer.
J. chem. Phys., Vol. 25, No. 1, 172 (July, 1956).

Radiationless transitions from higher excited states of molecules are ascribed to intramolecular sensitization which favours transitions from the lowest excited state. Internal conversion is, however, not completely excluded in specific cases. G.F.J.Garlick

539.132 : 535.343

ABSORPTION SPECTRA OF UNSYMMETRICAL CYANINES. See Abstr. 8669

539.132

8900. NUCLEAR MAGNETIC RESONANCE FIELD SHIFTS OF Si^{29} IN VARIOUS MATERIALS. G.R.Holzman, D.C.Lauterbur, J.H.Anderson and W.Koth.
J. chem. Phys., Vol. 25, No. 1, 172-3 (July, 1956).

A table of nuclear magnetic resonance chemical shifts for Si^{29} extending from +92 for silica to −48 parts in 10^6 for $(CH_3)_3SiF$ relative to silicone DC 200 as zero. D.H.Whiffen

539.132 : 539.133

8901. DIMERIZATION OF SOLID GROUP IIIB TRIHALIDES. I. BROMINE NUCLEAR QUADRUPOLE RESONANCE SPECTRUM OF $AlBr_3$. R.G.Barnes and S.L.Segel.
J. chem. Phys., Vol. 25, No. 1, 180 (July, 1956).

The three Br^{81} resonances at 81.815 ± 0.006, 95.055 ± 0.006 and 96.426 ± 0.003 Mc/s and similar Br^{79} resonances for $AlBr_3$ at liquid N_2 temperatures are consistent with the bridged dimeric structure. D.H.Whiffen

539.132

8902. F^{19} MULTIPLETS IN THE NMR SPECTRUM OF $CF_3CCL{=}CFCl$. H.M.McConnell and C.A.Reilly.
J. chem. Phys., Vol. 25, No. 1, 184 (July, 1956).

The F nuclear magnetic resonance signals of $CF_3CCl{=}CFCl$ shows not only two lines due to the CF_3 resonance split by the remaining F and the four lines from this F split by the CF_3 group, but also an unexplained line between the first-mentioned pair. D.H.Whiffen

539.132

8903. PURE QUADRUPOLE SPECTRA OF THE ISOMERS OF BENZENE HEXACHLORIDE. Y.Morino, I.Miyagawa, Y.Chiba and T.Shimozawa.
J. chem. Phys., Vol. 25, No. 1, 185 (July, 1956).

The pure quadrupole spectra of α, β, γ and δ benzene hexachloride (hexachlorcyclohexane) near 37 Mc/s have been measured and shown to consist of 6, 1, 5 and 6 frequencies respectively. These numbers are the same as the distinguishable Cl in the crystal unit cell but are not related to the distinguishable Cl of the individual molecules, namely, 2, 1, 4 and 4. Inter and intra-molecular splittings must be comparable in magnitude. D.H.Whiffen

539.132 : 538.222

8904. SPIN DENSITY IN NAPHTHALENE NEGATIVE ION. T.R.Tuttle, Jr, R.L.Ward and S.I.Weissman.
J. chem. Phys., Vol. 25, No. 1, 189 (July, 1956).

The hyperfine structure of the electron spin resonance of the naphthalene negative ion is explained by two sets of four equivalent protons with couplings of 1.79 and 5.01 Oe. These are assigned to the β and α positions respectively by comparison with the deutero naphthalene spectra. The unpaired spin density is 0.010 and 0.0035 at the α and β H atoms in units of unity for a free H atom. D.H.Whiffen

539.132 : 538.222

8905. C^{13} HYPERFINE SPLITTING IN NAPHTHALENE NEGATIVE ION. T.R.Tuttle, Jr and S.I.Weissman.
J. chem. Phys., Vol. 25, No. 1, 189-90 (July, 1956).

This was measured for a sample containing 53 atom percent of C^{13} in the α position. This spectrum contained 21 lines with extreme interval of 34.3 Oe. The C^{13} splitting is 7.1 Oe, giving a spin density of 0.056 at the C nucleus and 0.010 at the adjoining proton. J.Jacobs

539.132

8906. Cl^{35} NUCLEAR QUADRUPOLE RESONANCES IN $TiCl_4$ AND WCl_6. R.P.Hamlen and W.S.Koski.
J. chem. Phys., Vol. 25, No. 2, 360 (Aug., 1956).

539.132

8907. OBSERVATION OF HINDERED ROTATION IN SOLID 1, 2-DICHLOROETHANE BY NUCLEAR QUADRUPOLE RESONANCE. H.W.Dodgen and J.L.Ragle.
J. chem. Phys., Vol. 25, No. 2, 376 (Aug., 1956).

Measurement of the frequency of the chlorine resonance in solid 1, 2-dichloroethane at several temperatures up to the melting point (238°K) indicates that the axis of hindered rotation lies near the Cl—Cl axis. G.I.W.Llewelyn

539.132

8908. QUANTUM-MECHANICAL CALCULATION OF THE BOND ENERGY OF THE NITROGEN MOLECULE. H.J.Brüchner.
J. chem. Phys., Vol. 25, No. 2, 367 (Aug., 1956).

The ground-state energy was calculated by the VB method, taking account of resonance between the standard N_2 triple bond structure and four other linearly independent ones. All permutations between the valence electrons were considered in the Hamiltonian matrix. A second electrostatic force calculation was made, the results for internuclear distance and dissociation energy being in fairly good agreement with those of the first calculation. J.Jacobs

539.132

8909. ATOMIC POLARIZABILITY. M.Atoji.
J. chem. Phys., Vol. 25, No. 1, 174 (July, 1956).

An empirical relation between the atomic polarizabilities of Cl, Br, and I and their covalent single bond radii is presented. The connection between atomic polarizability and the nature of the chemical bonding is discussed with reference to the mercuric halides. G.Allen

539.132

8910. NEW METHOD FOR THE CALCULATION OF MOLECULAR MAGNETIC SUSCEPTIBILITIES. J.Guy and J.Tillieu.
J. chem. Phys., Vol. 24, No. 5, 1117 (May, 1956).

539.132

8911. HIGH-SPEED COMPUTATION OF MOLECULAR INTEGRALS. M.P.Barnett, H.H.Robertson and E.L.Albasiny.
J. chem. Phys., Vol. 25, No. 2, 367-8 (Aug., 1956).

Some three-centre one-electron integrals needed for ethylenic molecules were computed on a digital computer. These integrals measure the electrostatic attraction of a nucleus on an electron resonating between two others. J.Jacobs

539.133

8912. ELECTRONIC MOTION IN THE ROTATING H_2 MOLECULE. I.Espe.
Phys. Rev., Vol. 103, No. 5, 1254-7 (Sept. 1, 1956).

The contributions of the electrons in the H_2 molecule to the moment of inertia is calculated by assuming irrotational flow for the motion of the electrons. Approximate expressions for the flow are obtained by means of a variational principle.

It is found that the model accounts for at least 90% of the observed moment of inertia. Also the dependence of the moment of inertia on the internuclear spacing and the magnetic field of the electrons acting on the nuclei are calculated and found to be in rather good agreement with the experimental values. A.

539.133 : 535.338.334

8913. EVALUATION OF MOLECULAR QUADRUPOLE MOMENTS FROM MICROWAVE SPECTRAL LINE BREADTHS. I. THEORETICAL. W.V.Smith.
J. chem. Phys., Vol. 25, No. 3, 510-15 (Sept., 1956).

The breadths of microwave spectral lines in gas mixtures may arise from several different interactions. It is shown that when the radiating molecule is the linear molecule OCS, polarizability interactions predominate, but when the radiating molecule is NH_3 undergoing inversion, quadrupole moment interactions predominate. Consequently, NH_3 is a particularly suitable molecule to use as a "probe" to measure quadrupole moments of other molecules. An improved theoretical analysis leads to a revision of previously published molecular quadrupole moments. A.

539.133

8914. APPROXIMATE METHOD IN CALCULATING MEAN-SQUARE AMPLITUDES OF BONDED INTERATOMIC DISTANCES. K.Kimura and M.Kimura.
J. chem. Phys., Vol. 25, No. 2, 362 (Aug., 1956).

The method used to calculate the amplitude of the C—O bond in CH_3OH (Abstr. 5302/1956) is successfully applied to various types of bonds. Information and assumptions about force constants are not required for the calculations.
G.Allen

539.133 : 535.343

STRUCTURE OF THE FREE NH_2 RADICAL. See Abstr. 8664

539.133

8915. FURTHER NOTE ON THE CALCULATION OF BOND LENGTHS OF CARBON—CHLORINE BONDS. T.Anno and A.Sadô.
J. chem. Phys., Vol. 25, No. 1, 176-7 (July, 1956).

The theoretical curve relating bond order to bond length for C—Cl bonds (Bulletin of the Chemical Society of Japan, Vol. 28, 350, 1955) is recalculated using new values for α_{Cl} and β_{CCl} obtained from experimental data on chlorinated hydrocarbons. The new values of α_{Cl} and β_{CCl} do not affect the agreement previously obtained between theory and experiment. G.Allen

539.133

8916. STRUCTURE OF THE HEXAFLUOROBENZENE MOLECULE. L.Delbouille.
J. chem. Phys., Vol. 25, No. 1, 182-3 (July, 1956).

The frequencies and polarization character of observed infrared and Raman bands indicate that the C_6F_6 molecule belongs to the D_{6h} symmetry. Force constants for C_6F_6 are deduced. G.I.W.Llewelyn

539.133 : 537.226.2

8917. DETAILED STRUCTURE OF COPOLYMERS FROM DIELECTRIC MEASUREMENTS. R.N.Work and Y.M.Tréhu.
J. appl. Phys., Vol. 27, No. 9, 1003-11 (Sept., 1956).

The effective dipole moment of each polar group in polar-polar or polar-nonpolar copolymers is expressed in terms of the moment of an equivalent isolated polar group and the average of the vector sum of the moments of all of the polar groups surrounding it. It effects of short-range forces leading to angular correlations of dipole pairs are neglected except for interactions between nearest neighbours along the chain, an expression for the average of the effective moments of the two types of the polar groups present can be written as a function of the composition of the copolymer in the form

$$\langle\mu^2\rangle_{Av} = x_1(\mu_1^2)_{eff} + (1 - x_1)(\mu_2^2)_{eff} = L + Mx_1 + Nx_1P_{11}(x_1).$$

Here, x_1 is the mole fraction of one of the monomers in the copolymer, $(\mu_1^2)_{eff}$ and $(\mu_2^2)_{eff}$ are the squares of the effective moments of the two polar groups. L, M and N are constants involving the dipole-moments of the equivalent isolated groups and the average cosines of the angles between nearest-neighbouring dipole pairs of types 1-1, 1-2 and 2-2. The quantity $P_{11}(x_1)$ is the probability of a monomer of type 1 adding to a free radical of its own kind at the end of a growing chain in the polymerization mixture. It can be calculated from r_1 and r_2, the reactivity ratios of the two monomers, and the composition of the monomer feed mixture. Interactions extending farther along the chain than nearest neighbours introduce terms in higher powers of $P_{11}(x_1)$. Onsager's equation for the dipole moments of molecules in mixtures of polar liquids has been modified to express the average of the effective moments of the polar groups present in terms of the dipolar contribution to the dielectric constant, $\epsilon_S - \epsilon_\infty$. Using this equation, values of $\langle\mu^2\rangle_{Av}$ have been calculated from measurements of $\epsilon_S - \epsilon_\infty$ for several copolymers of poly-(p-chlorostyrene-styrene) representing the whole range of copolymer composition. Measurements were made on bulk copolymers at temperatures above the glass-transition temperature. A curve of the form $L + Mx_1 + Nx_1P_{11}(x)$ has been fitted within experimental error to the calculated values of $\langle\mu^2\rangle_{Av}$ over the whole range of copolymer composition. This indicates that within the limits of error of this work only nearest-neighbours on the polymer chain contribute to the effective moments of the polar groups. The average cosines have been calculated for the angles between each of the three kinds of dipole pairs in the copolymer. A.

ATOMS. NUCLEUS. ISOTOPES 539.15

539.152.1 : 539.153

8918. HOLES AND PARTICLES IN SHELL MODELS. D.M.Brink and G.R.Satchler.
Nuovo Cimento (Ser. 10), Vol. 4, No. 3, 549-57 (Sept., 1956).

The study of nuclear and atomic shell models involves the calculation of matrix elements of operators between many-body configurations. This paper shows how the occupation number representation of Dirac can be used in such calculations, especially for configurations near closed shells. Methods for the construction of many-body wave functions are given, and the equivalence of holes and particles discussed. Application is made to the calculation of transition matrix elements for holes and particles and to the investigation of two body interactions. In particular the interaction between holes and particles is considered. A.

539.152.1

8919. ON THE REAL PART OF THE COMPLEX POTENTIAL WELL OF THE NUCLEUS. A.Kind and L.Jess.
Nuovo Cimento (Ser. 10), Vol. 4, No. 3, 595-600 (Sept., 1956).

Starting from a well-defined assumption about nuclear forces, the real part of the complex potential which enters into the description of the neutron–nucleus interaction is determined for energies of the incoming neutron ranging from 0 to 400 MeV. The assumption is made that nuclear matter remains unperturbed as the neutron passes through it. The exchange character of nuclear forces is essential for the results obtained. A.

539.152.1

8920. GROUND-STATE PROPERTIES OF NONSPHERICAL NUCLEI. K.Gottfried.
Phys. Rev., Vol. 103, No. 4, 1017-31 (Aug. 15, 1956).

A knowledge of the wave-functions and energy levels for nucleonic motion in a nonspherical force field is a prerequisite

o any detailed comparison between the empirical data and the nodel of Bohr and Mottleson. An extremely simple model for his internal problem is provided by the motion of independent articles in an ellipsoidal oscillator potential. By minimizing he total energy of such a system, conclusions reached are 1) that deformations which possess an axis of symmetry are lways preferred by low-lying states, and (2) that this model annot reproduce the observed preponderance of positive qua- rupole moments. This last conclusion is unaltered by the sur- ace tension or Coulomb repulsion. The oscillator model is oo simplified for the computation of spins or magnetic moments μ). Wave-functions and energy levels are therefore deter- nined for independent-particle motion in a spheroidal square vell, including spin-orbit coupling. Because of the approxima- ions made in this calculation, levels cannot be used to com- ute the equilibrium shape, but only to assign the ground-state evel and wave-function. Thus the present scheme is intended o replace that of the shell model in the region of large defor- nations. With the exception of W^{183}, the spin has been correct- y assigned to all the odd-A nuclei for which $150 \lesssim A \lesssim 190$. The ease and consistency with which such an assignment can e made shows that the scheme is essentially correct for hose nuclei which possess large deformations, and whose odd article lies in the 50-82 shell or the lower part of the 82-126 hell. In addition, μ has been computed in this region. Here he agreement is more limited, but there are a number of mportant successes: the large difference in μ for the uropium isotopes, the ratio of the magnetic moments of the wo hafnium isotopes, both μ and the decoupling coefficient for Tm^{169}, and μ for $Yb^{171\ 173}$, Re, Eu^{151} and Os^{189}. The properties f the ground state and first excited state of Ag^{109} are also ound to be in good agreement with the theory. A.

539.152.1

8921. RATIOS OF TRANSITION PROBABILITIES BETWEEN ROTATIONAL STATES IN ODD-A NUCLEI. G.Goldring and G.T.Paulissen.

Phys. Rev., Vol. 103, No. 5, 1314-20 (Sept. 1, 1956).

A γ-coincidence method has been developed for measuring relative electric excitation cross-sections of the first two excited levels in odd-A nuclei. This method has been applied o eight nuclei in the region $63 \leq Z \leq 75$. In general the results agree very well with the strong-coupling collective-model theory, indicating that in any one nucleus Q is constant to within about 20%. The deviations, though small, are outside the limits of experimental error for a number of nuclei. A.

539.152.1

8922. INERTIAL PARAMETERS FOR COLLECTIVE NUCLEAR OSCILLATIONS. S.A.Moszkowski.

Phys. Rev., Vol. 103, No. 5, 1328-41 (Sept. 1, 1956).

Inertial parameters for nuclear rotation and quadrupole shape oscillation are known to be several times as large as he values assuming irrotational flow. These parameters may e calculated by using a method due to Inglis and applied in recent work by Bohr and Mottelson. The nucleus is assumed o be mainly in the lowest possible intrinsic state, but slightly perturbed by the time-dependence of the nuclear shape. It is convenient to separate the nuclear Hamiltonian into interact- ons of the individual nucleons with an average potential of the anisotropic harmonic oscillator type and residual interactions ndependent of deformation. Then the intrinsic motions of the nucleons must satisfy, at least approximately, self-consistency conditions between the potential and nuclear density. The nucleons outside closed shells are seen to contribute about alf of the nuclear deformation. The excess of the inertial parameters over the irrotational values is related directly to he spread in energy of admixed excited states of the intrinsic motion, an essential consequence of the approximately inde- pendent motions of the nucleons. The inertial parameters are determined mainly by excitation of nucleons outside closed shells and they are inversely proportional to the square of the average excitation energy within a major shell. In summary, the nuclear collective motion appears to resemble the shell model situation more than was thought previously, especially as regards the dominant role of the nucleons outside filled shells. Empirical values of the inertial parameters are dis- cussed in the light of these results, and a comparison is made with the recent analysis of Bohr and Mottelson. Anomalies in the empirical gyromagnetic ratios of rotational motion for odd-A nuclei result from the important role of the unpaired nucleon. With the aid of a simplified model in which the un- filled shell is assumed to be a p-shell, it is possible to ac- count qualitatively for a number of the observed features. A.

539.152.1

8923. NUCLEAR MANY-BODY PROBLEM. H.A.Bethe.

Phys. Rev., Vol. 103, No. 5, 1353-70 (Sept. 1, 1956).

A self-contained and largely new description is given of Brueckner's method for studying the nucleus as a system of strongly interacting particles. The aim is to develop a method which is applicable to a nucleus of finite size and to present the theory in sufficient detail that there are no ambiguities of interpretation and the nature of the approximations required for actual computation is clear. It is shown how to construct a model of the nucleus in which each nucleon moves in a self- consistent potential matrix of the form $(r'|V|r)$. The potential is obtained by calculating the reaction matrix for two nucleons in the nucleus from scattering theory. Some complications arise in the definition of the energy levels of excited nucleons. The actual wave-function is obtained from the model wave- function by an operator which takes into account multiple scat- tering of the nucleons by each other. The method of Brueckner is a vast improvement over the normal Hartree—Fock method since, in calculating the self-consistent potential acting on an individual particle in the model, account is already taken of the correlations between pairs of nucleons which arise from the strong internucleon forces. Although the actual wave- function is derivable from a wave-function which corresponds essentially to the shell model, the probability of finding a large nucleus of mass number A "actually" in its shell model state is small (of order $e^{-\alpha A}$, where α is a constant). The influence of spin is investigated. In the case of an infinite nucleus, an integral equation is obtained for the reaction matrix, just as in the theory of Brueckner and Levinson. The exclusion principle must be applied in intermediate states in solving the integral equation for the reaction matrix. This makes an enormous difference for the solution. When the exclusion principle is used, the scattering matrix is very nearly given by the Born approximation, for any well-behaved potential. Numerical results are given for the case when nucleons interact only in S states, an assumption which leads to saturation without a repulsive core. The agreement with observation is fair to poor, owing to the poor assumption for the interaction. Brueckner's result that three-particle clusters give a small contribution to the energy is confirmed, although the numerical value is many times his result; the calculation is then extended to the case of a repulsive core. The depend- ence of the binding energy on the mass number A is investigat- ed for saturating and nonsaturating interactions. Terms of relative order 1/A are calculated, and it is shown that these terms are much smaller than Brueckner and Levinson found, making the method also applicable to relatively small nuclei. Some aspects of the problem of the finite nucleus are dis- cussed, including that of degeneracy. A.

539.152.1 : 537.13

8924. STRUCTURE OF THE PROTON. E.E.Chambers and R.Hofstadter.

Phys. Rev., Vol. 103, No. 5, 1454-63 (Sept. 1, 1956).

The structure and size of the proton have been studied by means of high-energy electron scattering. The elastic scat- tering of electrons from protons in polyethylene has been in- vestigated at the following energies in the laboratory system: 200, 300, 400, 500 and 550 MeV. The range of laboratory angles

examined has been 30° to 135°. At the largest angles and the highest energy, the cross-section for scattering shows a deviation below that expected from a point proton by a factor of about nine. The magnitude and variation with angle of the deviations determine a structure factor for the proton, and thereby determine the size and shape of the charge and magnetic-moment distributions within the proton. An interpretation, consistent at all energies and angles and agreeing with earlier results from this laboratory, fixes the r.m.s. radius at $(0.77 \pm 0.10) \times 10^{-13}$ cm for each of the charge and moment distributions. The shape of the density function is not far from a Gaussian with r.m.s. radius 0.70×10^{-13} cm or an exponential with r.m.s. radius 0.80×10^{-13} cm. An equivalent interpretation of the experiments would ascribe the apparent size to a breakdown of the Coulomb law and the conventional theory of electromagnetism. A.

539.152.1

8925. ELECTRON SCATTERING FROM THE DEUTERON. J.A.McIntyre.
Phys. Rev., Vol. 103, No. 5, 1464-71 (Sept. 1, 1956).

The charge distribution of the deuteron has been studied by electron scattering experiments using 188 MeV and 400 MeV electrons. Both deuterated-polyethylene foils and deuterium gas targets were used. Two different scattering apparatuses were also used. All experiments are consistent with the following results. The charge of the deuteron is extended over a larger volume than that inferred from low-energy neutron–proton scattering. Specifically, the effective range of the neutron–proton potential is found to be at least $(2.18 \pm 0.15) \times 10^{-13}$ cm as compared with the n–p scattering result of $(1.70 \pm 0.03) \times 10^{-13}$ cm. It is possible also to fit the data using a 1.70×10^{-13} cm effective range, and a deuteron consisting of a point neutron and a proton with an r.m.s. radius of $(0.82 \pm 0.17) \times 10^{-13}$ cm. This procedure, however, violates the assumption of the charge independence of the internal structure of nucleons. Finally, the 1.70×10^{-13} cm effective range could be preserved by suitably modifying the Coulomb law at small distances. A.

539.152.1

8926. ON QUANTUM-MECHANICAL NUCLEAR DIPOLE VIBRATIONS. J.Fujita.
Progr. theor. Phys., Vol. 14, No. 4, 400-2 (Oct., 1955).

A survey of the various models which have been used to treat the dipole vibration of the nucleus in an attempt to explain the nuclear photoeffect, in particular, the giant resonance. In most of the treatments the approach has been semi-classical and the detailed mechanism of the giant resonance is not clear. The differences between the various models are stated and it is shown where they overlap and how they are related. D.J.Prowse

539.152.1

8927. MESON-THEORETICAL POTENTIALS IN N^{14}. S.Otsuki, T.Sawada and S.Suekane.
Progr. theor. Phys., Vol. 14, No. 6, 606-7 (Dec., 1955).

It is shown that using the intermediate coupling shell model, both Li^8 and N^{14} can be treated simultaneously, because the former belongs to a p^3 configuration and the latter to a p^{-3} configuration, so the relative energy levels are solutions of the same secular equation, only the sign of the spin-orbit coupling parameter being opposite. It is concluded that the meson-theoretical potential is favourable qualitatively for N^{14} assuming some over-simplification of the model and possible changes in the potential parameters. Theoretical curves for the N^{14} energy levels, and the variations of magnetic, and quadrupole moments with frequency are graphed. J.J.Phipps

539.152.1

8928. A COLLECTIVE DESCRIPTION OF THE SURFACE OSCILLATION OF ATOMIC NUCLEI. EXTENSION OF TOMONAGA'S METHOD TO THREE DIMENSIONAL NUCLEUS. T.Miyazima and T.Tamura.
Progr. theor. Phys, Vol. 15, No. 3, 255-72 (March, 1956).

Tomonaga's ingenious method of the description of collective surface motion is extended to the case of three-dimensional nuclei. In this extension a difficulty appears which did not arise with Tomonaga's two-dimensional example, and a method of avoiding it is given in this paper. Applying this method a Hamiltonian is derived which contains terms standing in one to one correspondence with those of Bohr's together with other correction terms. Brief calculation of the nuclear surface energy is also performed. The method of collective description mentioned here may be useful for many other problems where collective motion takes place. A.

539.152.1

8929. ON THE ROTATIONAL STATES OF NUCLEI. I. CALCULATION OF MOMENT OF INERTIA. G.Lüders.
Z. Naturforsch., Vol. 11a, No. 8, 617-26 (Aug., 1956). In German.

The nuclear moment of inertia for the Bohr–Mottelson collective model is calculated directly from the equations of motion and the result compared with that for the "equivalent" liquid drop (Inglis, Abstr. 1110/1955). The agreement is good and the connection between the present treatment and that of Inglis is discussed. Calculation of lifetimes is postponed to a later paper. J.W.Gardner

539.152.1

8930. PECULIARITIES OF THE LEVELS OF NON-SPHERICAL EVEN-EVEN NUCLEI. I.S.Shapiro.
Zh. éksper. teor. Fiz., Vol. 30, No. 5, 975-7 (1956). In Russian.

Selection rules and possible transitions are discussed. G.E.Brown

539.152.2

8931. EMPIRICAL DETERMINATION OF NUCLEAR MOMENTS OF INERTIA AND INTRINSIC QUADRUPOLE MOMENTS. E.D.Klema and R.K.Osborn.
Phys. Rev., Vol. 103, No. 3, 833-4 (Aug., 1956).

An empirical parameter k is defined as the ratio of the number of particles outside filled shells (or number of holes, whichever is smaller) to the total number of particles in the nucleus. It is assumed that the fractional mass kM rotates as a rigid rotator. Then the moment of inertia, energy and quadrupole moment may be expressed as functions of k. Further, from the measured energy of the first excited 2^+-state one can obtain the intrinsic quadrupole moment for a number of E-E nuclei. The concept of a fractional mass (or charge) participating in nuclear rotations may be extended to electrodynamic transitions between nuclear ground states and rotational levels. L.Pincherle

539.152.2

8932. THE THEORY OF RELAXATION TIMES IN QUADRUPOLE RESONANCE. Y.Ayant.
J. Phys. Radium, Vol. 17, No. 4, 338-42 (April, 1956). In French.

A quantitative theoretical discussion of quadrupole resonance relaxation times in one- and two-dimensional lattices with a qualitative extension to three dimensions. The lattice force constants are required and may be obtained from the Raman frequencies. D.H.Whiffen

539.152.2

8933. NUCLEAR QUADRUPOLE RESONANCE. H.Kopfermann.
J. Phys. Radium, Vol. 17, No. 4, 366-71 (April, 1956). In French.

539.152.2

8934. ON THE SHAPE OF DISPERSION SIGNALS IN THE MAGNETIC RESONANCE OF ATOMIC NUCLEI IN A HIGH FREQUENCY MAGNETIC FIELD. N.M.Ievskaya.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1040-6 (1956). In Russian.

Approximate solutions of the system of equations describing the behaviour of the magnetization vector components in a strong high-frequency magnetic field have been obtained for intermediate relaxation times and symmetric and non-symmetric sinusoidal modulation. An estimate of the accuracy and limits of validity of the approximation is made. Formulae for the longitudinal and transverse relaxation times are deduced from the solution. Results of an experimental study agree with the theoretical predictions. A.

539.153 : 538.113

8935. DEPENDENCE ON ATOMIC NUMBER OF THE DIAMAGNETIC SUSCEPTIBILITY CALCULATED FROM THE THOMAS–FERMI–DIRAC MODEL. L.H.Thomas and K.Umeda.
J. chem. Phys., Vol. 24, No. 5, 1113 (May, 1956).

Molar diamagnetic susceptibilities have been computed for neutral atoms (n = 0) and for positive ions (n = 1 to 4) from T–F–D charge distributions (Abstr. 458/1955). The numerical results are compared graphically with experimental values for the inert gas atoms, and homologous ions. G.Allen

539.153

8936. GROUND-STATE ENERGY OF TWO-ELECTRON ATOMS. E.A.Hylleraas and J.Midtdal.
Phys. Rev., Vol. 103, No. 3, 829-30 (Aug. 1, 1956).

The nonrelativistic energies for the ground states of H^-, He, Li^+... have been recalculated by means of an electronic computer using 18 and finally 24 terms in the wave-function. Besides familiar terms, four additional ones were used, originating from a nonconvergent logarithmic expression appearing in the formal solution of the wave equation. These terms gave a final contribution of 2-5 cm^{-1}. Improvements of 30-40 cm^{-1} on previous calculations were obtained for $Z \to \infty$ and for $Z = 1$. Even the ground state of He was improved by 2 cm^{-1}. L.Pincherle

539.153.4

8937. ON THE ORTHOGONALITY OF THE WAVE FUNCTIONS OF THE ELECTRONS IN AN ATOM. P.Szépfalusy.
Acta phys. Hungar., Vol. 5, No. 3, 325-38 (1955). In German.

In treating an atom by the method of the self-consistent field, the use of the Fock equation for a valence electron necessitates making its wave function orthogonal to those of the other electrons. Instead of doing so an extra energy term may be added to the equation. The physical significance of the term is discussed, and its relationship to expressions obtained by Gombás (Abstr. 9002/1952). P.M.Davidson

539.153.4

8938. EIGENFUNCTIONS AND ENERGY EIGENVALUES OF THE ELECTRONS OF THE Ag ATOM WITH ELECTRON EXCHANGE. R.Gáspár and K.Molnár-Ivanecsko.
Acta phys. Hungar., Vol. 6, No. 1, 105-18 (1956). In German.

A universal potential, which already includes the exchange energy, is employed. In addition to the eigenfunctions and eigenvalues of the silver atom, the diamagnetic susceptibility of the Ag^+ ion is calculated. G.E.Brown

539.153.4

8939. THE BLOCH–SIEGERT EFFECT IN SEVERAL-QUANTA RESONANCES. J.Brossel, J.Margerie and J.Winter.
C.R. Acad. Sci. (Paris), Vol. 241, No. 6, 556-8 (Aug. 8, 1955). In French.

The magnetic resonances observed in optically oriented Na vapour occur when $\omega_0 = p\omega + q\omega'$, where p and q are positive or negative integers and two r.f. fields of frequencies $\omega = 1.206$ Mc/s and $\omega' = 0.942$ Mc/s are simultaneously applied. Resonances with larger p and q increase rapidly in intensity with increased r.f. field strength, and the exact position varies slightly with an extended Bloch–Siegert formula. See also abstract following. D.H.Whiffen

539.153.4

8940. CALCULATION OF THE TRANSITION PROBABILITIES BETWEEN TWO ATOMIC LEVELS WHEN SEVERAL QUANTA ARE INVOLVED. J.Winter.
C.R. Acad.Sci. (Paris), Vol. 241, No. 7, 600-2 (Aug. 17, 1955). In French.

The calculations agree with findings of the preceding abstract. D.H.Whiffen

539.153.4

8941. ON THE RELATIVISTIC THOMAS–FERMI ATOM. G.S.Murty.
Progr. theor. Phys, Vol. 15, No. 5, 473-9 (May, 1956).

The method of March for obtaining the boundary values of the Thomas–Fermi function at high pressures has been extended to the relativistic case with and without temperature perturbation. The boundary values of the non-relativistic temperature-perturbed Thomas–Fermi function, obtained by the same method, are compared with the semi-empirical formulae of Gilvarry, thus obtaining a theoretical basis for the latter. The results may have some astrophysical applications. A.

539.155.2 : 537.571

SEPARATION OF METAL ISOTOPES ACCORDING TO THE IONIC MOBILITY IN LIQUID STATE. See Abstr. 8260

539.155.2 : 541.135.3

ISOTOPIC ENRICHMENT OF CHLORINE BY ELECTROLYTIC TRANSPORT IN MOLTEN ZINC CHLORIDE. See Abstr. 9012

RADIOACTIVITY. α-, β- AND γ-RAYS 539.16

539.16 : 550.93

RADIOACTIVE METHODS FOR DETERMINING GEOLOGICAL AGE. See Abstr. 9057

539.163

8942. DECAY OF NEUTRON-DEFICIENT ISOTOPES OF Pd AND Rh. S.Katcoff and H.Abrash.
Phys. Rev., Vol. 103, No. 4, 966-70 (Aug. 15, 1956).

Pd isotopes of masses 98, 99 and 101 were prepared by α-particle bombardment of ruthenium. The radiations of these isotopes and of their Rh daughters were investigated with a scintillation coincidence spectrometer. Rh^{98} decays with a half-life of 8.7 ± 0.1 min by emission of 2.5 ± 0.2 MeV positrons in coincidence with 650 ± 10 keV γ-rays. Its Pd^{98} parent was shown by successive daughter extractions to decay with a half-life of 17.5 ± 0.5 min. Rh^{99} (4.7 ± 0.1 hr) showed 0.74 MeV positrons (10%) in coincidence with 335 ± 10 keV γ-rays (70%). Other γ-rays were observed at 615 ± 15 keV (20%), 890 ± 20 keV (weak line coincident with 335 keV γ), 1.26 ± 0.03 MeV, and 1.41 ± 0.04 MeV (weak). Pd^{99} (21.6 ± 0.6 min) was identified by successive Rh daughter extractions. Its maximum positron energy is 2.0 ± 0.1 MeV and the following γ-rays were observed: 140, 275, 420 and 670 keV. The 140 keV γ-ray is the most intense and the 420 keV peak represents two γ-rays of about the same energy in cascade. Rh^{101} (4.7 ± 0.2 days) decays by electron capture followed by emission of 312 ± 10 keV γ-rays. Pd^{101} (8.5 ± 0.3 hr) emits 0.58 ± 0.04 MeV positrons (4%) by decay to the ground state of Rh^{101}. The γ-rays observed were at 288 keV (15%), 590 keV (15%), 720, 1190 and 1280 keV (last three less intense). The photopeak at 288 keV represents two coincident γ-rays of about the same energy. Tentative spin and parity assignments were made for the ground states in the nuclides investigated. Mass assignments were confirmed by a study of the relative yields of the various radioactive isotopes as the bombarding α-particle energy and isotopic composition of the Ru target were varied. A.

539.163.1

8943. DECAY OF Eu^{156}, Sm^{153}, Sn^{125}, and Br^{82}. V.S.Dubey, C.E.Mandeville and M.A.Rothman.
Phys. Rev., Vol. 103, No. 5, 1430-41 (Sept. 1, 1956).

The energies of the beta and gamma rays associated with the decay of Eu^{156}, Sm^{153}, Sn^{125}, and Br^{82} have been determined by scintillation spectrometry, and coincidence relationships have been investigated when possible. In most instances, values of log ft for the beta spectra have been determined from a consideration of the decay scheme and the relative intensities of gamma rays. The results obtained have been interpreted as indicating the following excited energy states of the residual nuclei:- Gd^{156} : 18 and 102 keV; Eu^{153} : 100, 170, and 700 keV; Sb^{125} : 1070, 1410, 1880, 1970, and 2110 keV; Kr^{82} : 770, 1450, 1800, 2060, and 2620 keV. The results of the measurements have been considered in relation to the single-particle model of the nucleus to ascertain likely spin values. A.

539.163.2

8944. RADIOACTIVE DECAY OF La^{137} AND Ce^{137}. A.R.Brosi and B.H.Ketelle.
Phys. Rev., Vol. 103, No. 4, 917-20 (Aug. 15, 1956).

A long-lived radioactive isotope of lanthanum has been produced by neutron bombardment of natural cerium. It decays with emission of Ba X-rays and has been assigned as La^{137}. The K-electron capture half-life is $(6 \pm 2) \times 10^4$ yr calculated from the Ba K X-ray intensity and the yield of mass 137 atoms in the bombardment. Approximate measurements of neutron cross-sections of Ce^{136} gave 6.3 barns for activation of Ce^{137} and 0.6 barn for activation of Ce^{137m}. A previously unobserved 10 keV M1 transition has been discovered in the decay of Ce^{137}. A decay scheme is proposed which has a $g_{7/2}$ ground-state spin assignment for La^{137}. Electron capture to the $d_{3/2}$ ground state of Ba^{137} on the basis of this assignment is second-forbidden. A.

539.163.2

8945. HALF-LIFE OF Rb^{87}. L.T.Aldrich, G.W.Wetherill, G.R.Tilton and G.L.Davis.
Phys. Rev., Vol. 103, No. 4, 1045-7 (Aug. 15, 1956).

A comparison of the ratio, radiogenic Sr^{87}/Rb^{87}, found in eight Rb minerals of differing Rb content from the same rock unit has shown this ratio to be constant for a given mineral assemblage. This ratio has been measured on Rb minerals from six rock units for which concordant U–Pb ages ranging from 375 to 2700 million years have also been obtained. From the ratio radiogenic Sr^{87}/Rb^{87} and the age of the mineral obtained from the U–Pg age, the half-life of Rb^{87} is calculated to be $(5.0 \pm 0.2) \times 10^{10}$ yr. This lies in the range of values found by direct counting experiments. A.

539.164.75

8946. THE DIFFERENTIAL STOPPING POWER OF LIQUID WATER FOR α-PARTICLES. M.McInally.
Proc. Roy. Soc. A, Vol. 237, No. 1208, 28-38 (1956).

An accurate method is described for determining the differential stopping power of liquid water at α-particle energies between 4 and 6 MeV. α-Particles from a Th C' source pass through a steel capillary tube, whose covered end lies just below the water surface in a wide glass tank. After traversing the water film above the capillary tube the α-particles are detected by a movable proportional counter. The curve of count against distance is first plotted. Then the thickness of the water film is increased by adding a weighed quantity of water to the tank and the curve is plotted again. The air equivalent of the added layer of water is then derived from the displacement of the curve. A source of error in the measurements is hysteresis of the angle of contact of the water with the walls of the glass tank, but a correction may be derived by varying the length of the water–glass–air boundary of the system, or the error may be eliminated by using dilute solutions of detergents. At an α-particle energy of 5.5 MeV, the differential stopping power of one molecule of water relative to the average atom of air is found to be 1.45 ± 0.02, which is 0.02 less than the accepted value for an equivalent mixture of hydrogen and oxygen. The stopping power does not increase by more than 0.02 ± 0.015 between 5.7 and 4.3 MeV. A.

539.165

8947. ELECTRON CAPTURE OF Yb^{169} TO LEVELS IN Tm^{169}. J.W.Mihelich, T.J.Ward and K.P.Jacob.
Phys. Rev., Vol. 103, No. 5, 1285-92 (Sept. 1, 1956).

The decay of Yb^{169} by electron capture has been studied with permanent magnet spectrographs and scintillation counter techniques. Multipolarities of all transitions (including mixing) have been deduced. A level scheme is proposed. Two metastable levels of 4×10^{-7} and 4.5×10^{-8} sec have been found, in addition to the well known 6.4×10^{-7} sec level. These metastable levels are all depopulated by D + Q mixtures in which the dipole radiation is greatly retarded (by factors of 10^6 to 10^8) and the quadrupole radiation is retarded by factors of 10^2 to 10^3 as compared to the single particle estimates. For certain transitions the corrections to the M1 internal conversion coefficients (necessary because of finite nuclear size) have been obtained for the K, L_I and L_{II} shells. The screening correction for the K-LL Auger lines has been obtained for this nucleus (Z = 69). A.

539.166.74

8948. GAMMA-RAY SCATTERING FROM THIN SCATTERERS. D.G.Chappell.
Nucleonics, Vol. 14, No. 7, 36-7 (July, 1956).

Nomograms enabling rapid estimation of the photon flux reflected from a thin scatterer. R.D.Smith

539.166.74 : 537.531.85

SUMMARY OF RECENT MEASUREMENTS OF THE COMPTON EFFECT. See Abstr. 8227

539.166.835

8949. EFFECT OF AN ELECTRIC FIELD ON POSITRONIUM FORMATION IN GASES: EXPERIMENTAL. S.Marder, V.W.Hughes, C.S.Wu and W.Bennett.
Phys. Rev., Vol. 103, No. 5, 1258-65 (Sept. 1, 1956).

The increase in positronium formation due to a static electric field has been measured in various gases including He, Ne, A, H_2, D_2, N_2 and several more complex molecular gases by a study of the energy spectrum of the annihilation γ radiation. For the rare gases the increase has a sigmoid dependence on the ratio of electric field to pressure. The fraction of the positrons that form positronium increases by a maximum factor of 1.5, 1.4 and 2.1 for He, Ne and A, respectively. A similar increase was observed for H_2, D_2 and N_2. No effect of the electric field was found in the polyatomic gases CO_2, CH_4, C_2H_6 and CCl_2F_2, but a small anomalous decrease in positronium formation was seen in SF_6. Some data are given using a microwave field at 2460 Mc/s. The detailed theory of the increase given in the abstract following provides a basis for obtaining from the observed data values of the elastic scattering cross-section of positrons by the rare gas atoms, which are $0.023\pi a_0^2$, $0.12\pi a_0^2$, and $1.2\pi a_0^2 \pm 25\%$ for He, Ne and A, respectively. Quantitative interpretation for the polyatomic gases is more difficult. At the high electric fields for which positronium formation has its maximum value, the fraction of positrons forming positronium is between 50% and 80% for the rare gases and for H_2 and N_2; the mode of decay of the remaining positrons is not understood. A.

539.166.835

8950. EFFECT OF AN ELECTRIC FIELD ON POSITRONIUM FORMATION IN GASES: THEORETICAL. W.B.Teutsch and V.W.Hughes.
Phys. Rev., Vol. 103, No. 5, 1266-81 (Sept. 1, 1956).

A theory is developed to explain the influence of an electric field on positronium formation in gases. The Boltzmann equation is used to describe the behaviour of the positrons

under the combined influence of the electric field and molecular collisions. A diffusion equation in velocity space is deduced wherein the annihilation of free positrons and the disappearance of positrons by positronium formation are absorption terms. From this equation the functional dependence of the increase in positronium formation on the experimental parameters is calculated. The result describes correctly the experimental observations and yields information on the pertinent atomic processes. In particular, the cross-sections for the elastic scattering of positrons by helium, neon and argon are found to be $0.023\pi a_0^2$, $0.12\pi a_0^2$ and $1.5\pi a_0^2$, respectively, to about ± 25%. These values are considerably smaller than the corresponding quantities for electrons, and are in agreement with simple theoretical estimates. A.

NUCLEAR REACTIONS 539.17

539.17

8951. HIGH-ENERGY NUCLEAR PHYSICS. T.G.Pickavance, T.H.R.Skyrme and G.H.Stafford. Nature (London), Vol. 178, 115-18 (July 21, 1956).

Brief reports of a high-energy nuclear physics conference held in Moscow, May 14-22 (1956), and a symposium on high-energy accelerators and pion physics held by C.E.R.N. in Geneva, June 11-23 (1956).

539.172 : 530.145

SCATTERING CROSS-SECTION MAXIMA AND NUCLEAR BOUND STATES. See Abstr. 8594

539.172

NUCLEAR REACTIONS DUE TO COSMIC RAYS. See also under "Cosmic rays". Decimal classification 537.591.8

539.172

8952. DISINTEGRATIONS OF LIGHT NUCLEI OF NUCLEAR EMULSIONS BY SLOW π^- MESONS. M.Demeur, A.Huleux and G.Vanderhaeghe. Nuovo Cimento (Ser. 10), Vol. 4, No. 3, 509-25 (Sept., 1956). In French.

Ilford G.5 plates were exposed to slow π^- mesons produced by the Rochester Cyclotron. About 1500 σ-stars were classified according to the number of prongs and according to their production in a light nucleus (C, N, O) or a heavy nucleus (Br, Ag) of the emulsion. The examination of stars produced in the light nuclei has allowed to investigate the modes of desintegration of these nuclei. An extension of the scheme of Clark and Ruddlesden is proposed which gives an account of about $\frac{2}{3}$ of the observed stars. The remaining stars contain at least one fragment ($Z > 2$) and seem better interpreted by a mechanism of local heating. A.

539.172.13

8953. DEUTERON REACTIONS AND THE A = 14 POLYAD. J.B.French. Phys. Rev., Vol. 103, No. 5, 1391-3 (Sept. 1, 1956).

Possible deuteron stripping and pickup reactions involving various states for A = 14 and the two one-hole states for A = 15 are discussed in detail. They would give considerable information about the A = 14 wave-functions (particularly the C^{14} and N^{14} ground states) and also some valuable measurements of the basic single-particle Butler cross-section. A.

539.172.13

8954. COMPOUND NUCLEUS EFFECTS IN DEUTERON REACTIONS: $B^{10}(d, p)B^{11}$ AND $B^{10}(d, \alpha)Be^8$. J.B.Marion and G.Weber. Phys. Rev., Vol. 103, No. 5, 1408-13 (Sept. 1, 1956).

Angular distributions and excitation curves have been measured in the energy range E_d = 0.9 to 3.0 MeV for the four highest energy proton groups from the $B^{10}(d, p)B^{11}$ reaction and for the ground state α-particle group from the $B^{10}(d, \alpha)Be^8$ reaction. Several broad resonances were observed in the excitation curves, but the shapes of the curves obtained for the various particle groups differ considerably. Resonance effects are most pronounced for the ground state proton group, whereas the group leading to the third excited state of B^{11} shows no resonance behaviour. The (d, p) angular distributions suggest that compound nucleus formation plays an important role at these low bombarding energies. In particular, the stripping peak in the angular distribution of the ground state proton group (p_0) does not begin to take shape until $E_d > \sim 2$ MeV, while the p_1 distributions do not indicate a stripping peak at any energy. It is suggested that a shell-model effect is responsible for the lack of stripping in the case of the p_1 group. At E_d = 2.0 MeV, the p_2 angular distribution is almost symmetric about θ(c.m.) = 90° while the p_3 distribution shows a fairly well developed $l_n = 1$ stripping peak. The α-particle excitation curves indicate that forward—backward asymmetries in the angular distributions are averaged out when the energy interval E_d = 1 to 2.5 MeV is considered, in accordance with the statistical model prediction. A.

539.172.13

8955. STRIPPING REACTIONS AND NUCLEAR SHELL MODEL. S.Okai and M.Sano. Progr. theor. Phys., Vol. 14, No. 4, 399-400 (Oct., 1955).

It is shown that the deuteron stripping theory can be applied with success even when configurational mixing is present, the angular distributions then being characterized by two l-values. The percentage mixing of the configurations can be derived from the relative heights of the peaks. Several reactions have been calculated in terms of a mixing of the configurations and compared successfully with the experimental data. D.J.Prowse

539.172.13 : 539.152.1

8956. DEUTERON STRIPPING REACTIONS AND NUCLEAR SHELL STRUCTURE. S.Okai and M.Sano. Progr. theor. Phys., Vol. 15, No. 3, 203-21 (March, 1956).

Aims at showing that the mixing of the configurations can successfully be applied to deuteron stripping reactions when the angular distribution is characterized by two orbital angular momenta, and conversely that the percentage of mixing of the configurations can be determined from the observed relative heights of two peaks in the angular distribution. The calculations are based upon perturbation theory. The agreement between the calculated and observed angular distributions is good. For the reaction $F^{19}(d, p)F^{20}$, the unexpectedly small reduced widths are reasonably explained from the standpoint of configuration mixing. Through the investigation of $Mg^{25}(d, p)Mg^{26*}$, a probable spin assignment of 2 for the first excited state of Mg^{26} was found. Finally the relations between the type of mixing of the configuration used here and other types introduced to explain the quadrupole moments of odd nuclei are discussed. A.

539.172.13 : 539.152.1

NUCLEAR REACTIONS YIELDING EXCITED Li^6 NUCLEUS. See Abstr. 8326

539.172.3

8957. THE SCATTERING OF PHOTONS BY NUCLEONS AND NUCLEON ISOBARS. V.I.Ritus. Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1070-8 (1956). In Russian.

Calculation of the cross-section for scattering of photons by nucleons was carried out taking into account the nucleon excited state (isobar) and damping. The nucleon excited state is described by a relativistic equation for a particle with a spin and an isotopic spin of 3/2. The coupling constants are the same as those in two previous investigations (Abstr. 1243/1955 and 3137/1955) in which they were obtained by compari-

son with experiments on scattering and photoproduction of mesons by protons. A comparison of the calculations with experimental data on scattering of photons by protons would be an additional criterion of validity of the isobar concept and of the correctness of the chosen constants. A.

539.172.3

8958. ON THE SCATTERING OF PHOTONS BY NUCLEONS. R.N.Gurzhi.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1079-83 (1956). In Russian.

The scattering cross-section for photons scattered by nucleons is computed on basis of a semi-phenomenological isobar theory taking damping into account. A.

539.172.4

8959. NEUTRON RESONANCE PARAMETERS OF U^{235}. V.E.Pilcher, J.A.Harvey and D.J.Hughes.
Phys. Rev., Vol. 103, No. 5, 1342-52 (Sept. 1, 1956).

The neutron total cross-section of $_{92}U^{235}$ has been studied for neutron energies between 1.5 and 60 eV by using the Brookhaven fast chopper. The transmission data were analysed by the "area" method and the Breit–Wigner parameters obtained for the resonances up to 35 eV. The observed level spacing of 0.65 eV is the smallest yet reported for any isotope. The best available fission data have been combined with total cross-section data to obtain Γ_γ. The values of Γ_γ are approximately constant and are consistent with those of neighbouring heavy nuclei, whereas the Γ_n^0's have a very broad distribution similar to that observed in a number of other elements. The distribution of Γ_f's is also rather broad and resembles the neutron widths much more than the radiation widths in this respect. Average values of these parameters are presented, together with a discussion of the implications of these findings for current theories of fission. A.

539.172.4

8960. INELASTIC SCATTERING OF PHOTONEUTRONS OF 0.3, 0.77 AND 1.0 MeV ENERGY. Kh.R.Poze and N.P.Glazkov.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1017-24 (1956). In Russian.

The neutron inelastic scattering cross-section has been measured for three energies—0.3, 0.77 and 1.0 MeV and 13 elements:- uranium, bismuth, lead, mercury, tungsten, antimony, tin, cadmium, copper, nickel, iron, aluminium, sodium. The inelastic scattering cross-section for 0.8 and 1.0 MeV neutrons was found to be 1–2 barns in heavy nonmagic nuclei (uranium, mercury, tungsten). The cross-sections for neutrons of the same energy was found to be small, about 0.1–0.2 barns, in light magic nuclei (sodium, aluminium, lead, bismuth, tin, nickel). The mean energy of inelastically scattered neutrons has been estimated for incident neutrons of $E_0 = 1$ MeV and the energy of excited levels of some of the nuclei has been determined. A.

539.172.4

8961. ANGULAR DISTRIBUTION OF FRAGMENTS FROM NEUTRON-INDUCED FISSION OF U^{238} AND Th^{232}. R.L.Henkel and J.E.Brolley, Jr.
Phys. Rev., Vol. 103, No. 5, 1292-5 (Sept. 1, 1956).

The angular anisotropy of neutron-induced fission in Th^{232} and U^{238} has been investigated with a double fission chamber whose common centre high-voltage electrode was also a collimator. Ratios of $\sigma_F(0^\circ, E_n)/\sigma_F(90^\circ, E_n)$ were measured at a number of neutron energies from the thresholds near 1 MeV to 20 MeV. Larger variations were found in the anisotropy of fission fragments for U^{238} and Th^{232} than in earlier measurements for other nuclei, particularly at neutron energies immediately above the fission thresholds. For Th^{232}, there seems to be direct correlation between the variations in the anisotropy and those in the fission cross-section. At 1.6 MeV, corresponding to a peak in the Th^{232} fission cross-section, the angular distribution of fission fragments showed a maximum at 90° to the neutron direction. All previous measurements have shown maxima along the neutron direction. A.

539.172.4

8962. ANGULAR DISTRIBUTION OF FISSION FRAGMENTS AT THRESHOLD ACCORDING TO THE BOHR MODEL. L.Wilets and D.M.Chase.
Phys. Rev., Vol. 103, No. 5, 1296-7 (Sept. 1, 1956).

The sideways-peaked angular distribution of fragments from neutron-induced fission of Th^{232} near threshold, measured by Brolley and Henkel (preceding abstract), is found to be consistent with the model of A.Bohr. It is assumed that the saddle-point states through which the fissioning nucleus passes include primarily only a few members of a particular rotational band. Indications are adduced that this band has $K = 3/2$ and odd parity. A.

539.172.4

8963. PRODUCING CHEMICALS WITH REACTOR RADIATIONS. P.Harteck and S.Dondes.
Nucleonics, Vol. 14, No. 7, 22-5 (July, 1956).

The use of fission fragment ionization in gases to promote chemical reactions may prove an economic use of reactor radiations. Usable reactions involve C, H_2, N_2, O_2 which have small neutron absorption cross-sections. Measurements were made by irradiating in the Brookhaven National Laboratory reactor quartz vessels (≅ 100 cm^3) containing 5 mg enriched uranium powder and various gases at pressures up to 50 atm. and temperatures from −193° C to +300° C. Formation of CO and O_2 by irradiation of CO_2 showed that 20-25% of absorbed nuclear energy is stored chemically. A detailed study was made of the synthesis of NO_2 and N_2O from N_2-O_2 mixtures. The various competing reactions are considered in detail and it was shown that air at 10 atm. and 200° C gave the optimum yields of NO_2. The number of molecules synthesized per 100 eV absorbed was 4-5 for NO_2 and 2-2.5 for N_2O. Estimates show that the value of NO_2 produced by irradiation in a suitably designed 550 MW reactor might exceed the value of the electric power produced in a normal reactor of similar rating.

R.D.Smith

539.172.4

8964. CATALOGUE OF NUCLEAR REACTORS, 1955. Chalk River: Scientific Document Distribution Office, Atomic Energy of Canada; London: Her Majesty's Stationery Office (1956) 51 pp. [AECL No. 220 (CRR-590)].

An international list, prepared by Atomic Energy of Canada, Ltd, Chalk River Project, and Atomic Energy Research Establishment, Harwell, from the unclassified literature, of 46 reactors known to have reached criticality by July, 1955. Brief constructional details are given, where known, including fuel, reflector, shielding, size, coolant, temperatures, control, experimental facilities and estimated cost; also references to published descriptions.

539.172.4

8965. SOLUTIONS OF THE REACTOR KINETICS EQUATIONS FOR TIME VARYING REACTIVITIES. M.Ash.
J. appl. Phys., Vol. 27, No. 9, 1030-1 (Sept., 1956).

The solutions of the reactor kinetics equations for constant (step-function) reactivities are straightforward and well known. For time-dependent reactivities, however, only approximate solutions (excluding machine results) peculiar to the individual need are generally available. To obtain solutions for time dependent reactivities, the reactor kinetics equations are combined into a single integral equation of the Volterra type. The kernel of the integral equation characterizes the particular reactor through the decay properties of the six groups of delayed neutrons plus the prompt neutron generation time. A simple iterative procedure for hand computation of the solutions for general time dependent reactivities is given. Curves for two types of such reactivities (linear and $\cong \int_0^{vt} \sin^2 kx\,dx$) are included. A.

539.172.4

966. AUTOMATIC-BOILING-COLUMN REACTOR. C.F.Leyse.
Nucleonics, Vol. 14, No. 7, 42-5 (July, 1956).

A design for a boiling-water reactor which requires no control rods. The reactor core is in an elongated vertical cylinder and the reactor is brought to power by raising the water level in the tank. After the reactor reaches criticality it becomes self-regulating due to the variation in the water level resulting from differing rates of steam production. The reactor power is controlled by varying the feed water rate. Tests in the SPERT I reactor have shown the feasability of this method of reactor control. High power ratings, high fuel burn-up and easy override of xenon poisoning effects are claimed for this reactor. R.D.Smith

539.172.4

8967. NUCLEAR SAFETY IN PROCESSING REACTOR FUEL SOLUTIONS. D.Callihan.
Nucleonics, Vol. 14, No. 7, 38-41 (July, 1956).

The prevention of accidental accumulations of fissile materials leading to self-sustaining chain reactions during the processing of reactor fuels is an important consideration in plant design. By keeping below any one of the safe limits in terms of mass, volume, cylinder diameter, slab thickness or solution concentration which are tabulated for U^{233}, U^{235} and Pu^{239}, safety is assured. Three sets of graphs show the critical masses and volumes of reflected spheres and cylinders of U^{233}, U^{235} and Pu^{239} solutions and the application of these curves is discussed. R.D.Smith

ATOM AND MOLECULE BEAMS. MESONS. NEUTRONS 539.18

539.18 : 539.153

ENERGY LEVELS OF π^- MESIC ATOMS. See Abstr. 8332

539.18

8968. OBSERVATION OF A POSITIVE HYPERON DECAY AND A SINGLY CHARGED HYPERFRAGMENT. V.V.Alpers, I.I.Gurevich and A.P.Mishakova.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 2, 207-9 (1956). In Russian.

In area scanning an event $\Sigma^+ \rightarrow p + \pi^0 + Q$ is found and a microprojection of the production and decay of the Σ^+ is given. The observed hyperfragment is identified as ${}_{\Lambda}{}^{0}H_1{}^{3} \rightarrow p + p + \pi^-$, $Q = (40 \pm 5.8)$ MeV, $E_n = 1.94$ MeV. G.E.Brown

539.18 : 539.185

8969. SYSTEMATICS OF SALAM AND POLKINGHORNE AND THE HYPOTHESIS OF THE NEUTRON CHARGE. Ya.P.Terletskiĭ.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 2, 236-7 (1956). In Russian.

Selection rules for hyperon production and decay are formulated in terms of the "neutron charge" ϵ, which is taken as $\epsilon = \mu_3 - \tau_3$, where τ is the isotopic spin and μ is the isotopic orbital moment. In strong processes, $\Delta\epsilon = 0$, in weak processes, $|\Delta\epsilon| = 1$. G.E.Brown

539.18

8970. OBSERVATION OF THE PRODUCTION AND DECAY OF UNSTABLE PARTICLES IN AN EMULSION CAMERA. V.V.Alpers, I.I.Gurevich and L.V.Surkova.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 3, 421-2 (1956). In Russian.

Data on two τ-mesons and one Λ_0 are presented. G.E.Brown

539.18

8971. ABOUT THE POSSIBLE ANNIHILATION MODE OF A NUCLEON–ANTINUCLEON SYSTEM INTO A K–$\bar{K}$ PAIR. R.Gatto.
Nuovo Cimento (Ser. 10), Vol. 4, No. 3, 526-30 (Sept., 1956).

The selection rules for annihilation of a nucleon–antinucleon system into a K–antiK pair which are due to conservation of angular momentum, parity (P), particle-antiparticle conjugation quantum number (C), and G quantum number conservation are discussed. It is shown that, in the framework of the Lee–Yang suggestion of a parity conjugation invariance, two new quantum numbers (called E and F) can be constructed, which give rise to additional selection rules. A.

539.18

8972. PRODUCTION OF SLOW $\pi^{\pm}$-MESONS IN PHOTOGRAPHIC EMULSION NUCLEI BY PROTONS OF 460 MeV ENERGY AND NEUTRONS OF 400 MeV EFFECTIVE ENERGY. V.V.Alpers, L.M.Barkov, R.I.Gerasimova, I.I.Gurevich, K.N.Mukhin, B.A.Nikol'skiĭ and É.P.Toporkova.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1025-33 (1956). In Russian.

The production of charged π-mesons by 460 MeV protons and 400 MeV effective energy neutrons was studied by the emulsion camera technique. A.

539.18

8973. PRODUCTION OF SLOW $\pi^{\pm}$-MESONS IN PHOTOGRAPHIC EMULSION NUCLEI BY 660 MeV PROTONS. V.V.Alpers, L M.Barkov, R.I.Gerasimova, I.I.Gurevich, A.P.Mishakova, K.N.Mukhin and B.A.Nikol'skiĭ.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1034-9 (1956). In Russian.

The emulsion camera technique was applied to study the production of slow $\pi^{\pm}$-mesons in photographic emulsion nuclei under the action of 660 MeV protons. With the help of this method it was possible to investigate stars in which π-mesons were created and also to measure the energy and angular spectrum of $\pi^{\pm}$-mesons produced in nuclei. A.

539.185 : 539.172.11

8974. NEUTRON YIELDS FROM ACTINIDE–BERYLLIUM ALLOYS. O.J.C.Runnalls and R.R.Boucher.
Canad. J. Phys., Vol. 34, No. 9, 949-58 (Sept., 1956).

The neutron yields from the reaction $Be^9(\alpha, n)C^{12}$ have been measured for several actinide–beryllium alloys. The values for the beryllium thick target neutron yield, derived from the measurements on alloys containing Pu^{239}, Am^{241}, and Cm^{242}, are 60 ± 2, 74 ± 2 and 112 ± 3 neutrons per million alphas, respectively, when based on the Chalk River standard Ra^{226}-α-Be source. The dependence of the thick target yield, n_{max}, on the alpha-particle energy, E, is described by the empirical formula $n_{max} = 0.152\ E^{3.65}$ neutrons per million alphas. The yields for Ra-α-Be and Ac^{227}-α-Be, calculated from the latter expression, are in reasonable agreement with the best observed yields from powder-compacted sources. For Po-α-Be, the calculated thick target yield of 67 neutrons per million alphas lies within the limits of error of the yield observed by several earlier workers. A.

539.185 : 539.172.11

8975. MEASUREMENT OF THE NEUTRON YIELDS FROM ACTINIDE–BERYLLIUM ALLOYS. G.C.Hanna and O.J.C.Runnalls.
Canad. J. Phys., Vol. 34, No. 9, 959-67 (Sept., 1956).

Some of the sources were compared with primary neutron standards in a manganese sulphate bath. The experimental procedure is described in detail and corrections for the loss of neutrons from the bath are discussed. These measurements include a comparison of the Chalk River Ra-α-Be and the National Bureau of Standards Ra-γ-Be standard sources. The majority of the actinide–beryllium alloy sources were then compared with the standardized sources in simple boron trifluoride counter systems. A.

PA

539.185

8976. SOME TOPICS IN NEUTRON DIFFUSION THEORY. J.H.Tait.
Rep. Progr. Phys., Vol. 19, 268-96 (1956).

This paper is divided into four sections. In the first section the integro-differential neutron transport equation is given in its most general form. The form of the scattering law for elastic collisions with moderating nuclei, at rest or in motion, is discussed. The second section deals with the spectrum of neutrons in an infinite moderating medium, including the case when the medium is at a non-zero temperature. The determination of the spectrum is useful in the elucidation of various problems in the physics of thermal reactors, as the presence of large amounts of capturing material prevents the neutrons from reaching thermal equilibrium with the moderating atoms. A comparison of the calculations with experimental determinations of the neutron spectrum is given. In the third section methods of calculating the spatial distribution at large distances from the neutron source are described. The fourth section is devoted to calculations of critical size. An indication is given of the accuracy of the diffusion approximation when it is used for calculating the critical size of small systems. A.

539.185 : 539.219

NEUTRON DIFFRACTION BY A Ti–Zr SYSTEM. PRODUCTION OF A NON-SCATTERING ALLOY. See Abstr. 8984

539.185.7 : 621.374.32

8977. ELECTRONIC APPARATUS FOR THE MEASUREMENT OF DIFFUSION LENGTH IN GRAPHITE. M.Le Baud.
Onde élect., Vol. 35, 833-6 (Oct., 1955). In French.

Describes an automatic four-channel scaler, used with a BF_3 chamber, and synchronized, optically, with a neutron beam modulator. On manual initiation, pairs of channels record, respectively, the in-phase and anti-phase modulation components during defined intervals, the circuit inhibiting partial counts. (For experimental details and theory, see Abstr. 4029/1956). T.H.D.Attewell

539.89 : 536.423.4

MIST FORMATION AT HIGH PRESSURES. See Abstr. 8733

STRUCTURE OF SOLIDS 539.2

539.211

8978. KINEMATOGRAPHIC STUDY OF TENSILE FRACTURE IN POLYMERS. A.M.Bueche and A.V.White.
J. appl. Phys., Vol. 27, No. 9, 980-3 (Sept., 1956).

High-speed motion pictures were taken of silicone rubber, irradiated polyethylene, Plexiglas II, and aluminium foil while they were being broken. Fractures started internally in some of the silicone samples but at the edges of all of the others. The rates of crack growth and the rates of retraction of the ends of the rubber samples were measured. The velocities with which the cracks grew were compared with the results of the theories of Poncelet, Yoffe, Mott, and Roberts and Wells. Their prediction, that the velocities should be about one half those of transverse waves in the media, was found to represent the data for materials with moduli differing by five decades. After fracture, the ends of the rubber samples contracted with velocities approximately equal to the velocities of longitudinal waves in these samples. A.

539.217 : 537.311.33

THE DIFFUSION OF IMPURITIES IN INDIUM ARSENIDE. See Abstr. 8198

539.217

8979. NEW EXPERIMENTAL METHOD FOR THE EVALUATION OF DIFFUSION CONSTANTS IN ALKALI HALIDES. A.Glasner and R.Reisfeld.
J. chem. Phys., Vol. 25, No. 2, 381-2 (Aug., 1956).

A rough method applicable to those impurities showing a characteristic optical absorption in the alkali halide. Disks are prepared from a mixture of the selected alkali halide with the impurity salt and the extent of the diffusion of the impurity into the alkali halide is followed optically. The determination of the absolute diffusion coefficient, however, depends on the particle size in the mixture, which may be unknown. Some preliminary results are given for Tl and Pb in KCl. A.B.Lidiard

539.217

8980. STRUCTURE SENSITIVITY OF Cu DIFFUSION IN Ge. A.G.Tweet and C.J.Gallagher.
Phys. Rev., Vol. 103, No. 3, 828 (Aug. 1, 1956).

The mean diffusion coefficient at 710° C has been found to vary with dislocation density from $> 4 \times 10^{-5}$ cm²/sec in Ge specimens containing many low-angle grain boundaries to only 2×10^{-8} cm²/sec in the most perfect specimens ($< 10^4$ dislocation-lines/cm²). A.B.Lidiard

539.217

8981. SELF-DIFFUSION IN SILVER–ZINC. D.Lazarus and C.T.Tomizuka.
Phys. Rev., Vol. 103, No. 5, 1155-8 (Sept. 1, 1956).

The diffusities of Ag^{110} and Zn^{65} in an alloy of 70 atomic % Ag and 30 atomic % Zn have been measured over the temperature range 500-700° C, by using sectioning techniques. The temperature dependence of the diffusion coefficients is given by $D_{Ag} = (0.29 \pm 0.07) \exp[-(35\,990 \pm 410)/RT]$ cm²/sec, and $D_{Zn} = (0.46 \pm 0.08) \exp[-(35\,200 \pm 290)/RT]$ cm²/sec. Consideration of the effects of small differences in chemical composition indicates that the activation energy varies linearly with composition. The activation energies for diffusion apparently differ significantly from the average value derived from internal friction measurements. This difference is shown to be compatible with the fundamental diffusion process in a binary system. Comparison of the results with measurements in AgCd alloys shows that Zn is considerably more effective than Cd in increasing the rate of diffusion relative to that in pure Ag. A.

539.217

8982. SELF-DIFFUSION IN SILVER. C.T.Tomizuka and E.Sonder.
Phys. Rev., Vol. 103, No. 5, 1182-7 (Sept. 1, 1956).

Self-diffusion coefficients in single crystals of pure silver were determined between 630° C and 935° C. The results can be expressed by $D = 0.40 \exp(-44\,090/RT)$ cm²/sec. The activation energy agrees with the value extrapolated from the results of diffusion in impure silver crystals. A.

539.217

8983. SELF-DIFFUSION OF GOLD. B.Okkerse.
Phys. Rev., Vol. 103, No. 5, 1246-9 (Sept. 1, 1956).

The self-diffusion of gold was measured in single crystal specimens of 99.8 and 99.999% purity in the temperature range from 600-954° C, by using Au^{198} as tracer and applying the sectioning technique. The temperature dependence of the self-diffusion coefficient is given by

$$D = (0.031 \pm 0.004) \exp[-(39\,360 \pm 280)/RT] \text{ cm}^2/\text{sec}.$$

Together with recently reported data on self-diffusion of copper, silver and lead, this result is compared with empirical and theoretical predictions. A.

539.219 : 538.27

THE DE HAAS-VAN ALPHEN EFFECT IN ALLOYS. See Abstr. 8284

539.219 : 539.185

3984. NEUTRON DIFFRACTION STUDY OF TITANIUM–ZIRCONIUM SYSTEM. S.S.Sidhu, L.Heaton, D.D.Zauberis and F.P.Campos.
J. appl. Phys., Vol. 27, No. 9, 1040-2 (Sept., 1956).

The titanium and zirconium alloy system consists of a continuous series of random substitutional solid solutions of solvent and solute atoms. Titanium scatters thermal neutrons in the opposite phase from those scattered by zirconium, the scattering amplitudes being: $b_{Ti} = -0.38 \times 10^{-12}$ cm and $b_{Zr} = 0.62 \times 10^{-12}$ cm. An alloy containing 62 atomic % titanium and 38 atomic % zirconium is developed that gives no coherent scattering reflections in its neutron diffraction pattern, and is extremely useful in constructing devices in which scattering of thermal neutrons is not desired. Based on negative and positive scattering amplitudes of different isotopes of the same element for thermal neutrons, development of isotopic alloys is suggested. A.

539.219

8985. HOMOGENIZATION OF SOLID SOLUTIONS. A PROPOSED NEW TECHNIQUE. F.M.Acampora, A.S.Tompa and N.O.Smith.
J. chem. Phys., Vol. 24, No. 5, 1104 (May, 1956).

The solutions are prepared without resorting to melting or use of a solvent. A mixture of KCl and KBr is compressed to a pellet at a pressure of 13 000 atm and then ground to 200 mesh. After ten compressions homogeneity is achieved. This technique has also been applied to isomorphous covalent solids. G.Allen

539.219 : 538.222

8986. THE MOMENTS OF THE ABSORPTION CURVES IN SOLID SOLUTIONS. G.Ya.Glebashev.
Zh. éksper. teor. Fiz., Vol. 30, No. 3, 612 (1956). In Russian.

The probability of filling an arbitrary lattice point in a growing crystal of two salts with a paramagnetic ion is assumed to be independent of the way in which other lattice points are filled. The zeroth-, second- and fourth-order moments of the paramagnetic resonance absorption at high frequency are then computed. The ratio 4th/(2nd moment)^2 increases with decrease in concentration of paramagnetic ions, whereas the half-width increases initially, reaches a maximum, and with further dilution decreases again. J.Jacobs

539.231 : 548.232

8987. THE STRUCTURE OF THIN IRON FILMS DEPOSITED BY EVAPORATION IN VACUO. J.Brož, V.Syneček and V.Havel.
Czech. J. Phys., Vol. 5, No. 4, 547-9 (Dec., 1955). In Russian.

Fe was evaporated on to a glass surface (by heating electrically to 1470°C) to a thickness of 2000 to 3000 A. Electron diffraction showed an oriented texture such that the [111] axis of the b.c.c. cell was normal to the layer. A.L.Mackay

539.232 : 539.27 : 548.5

8988. THE STRUCTURE AND GROWTH OF OXIDE LAYERS FORMED ON BERYLLIUM. I.S.Kerr and H.Wilman.
J. Inst. Metals, Vol. 84, Pt 10, 379-85 (June, 1956).

An electron-diffraction study of oxide layers on beryllium has established that on polycrystalline metal surfaces, at 300°C and over, the oxide developed in a one-degree orientation which varied with the temperature of formation. On abraded beryllium below 700°C, the BeO grew in the (001) orientation, but above 700°C in {100}. The oxide formed on smooth, electropolished, coarsely crystalline beryllium at temperatures up to 250°C had a grain-size of about 10 A, but that formed at 300°C and above measured 60 A or more, with preferred (001) orientation up to 700°C. Growth of the oxide air at room temperature was not increased by irradiation with ultraviolet light. On vacuum-deposited beryllium surfaces, the oxide grew epitaxially on the exposed (001) and (110) metal faces, even though at room temperature the grain-size of the oxide crystals was only about 10 A. This striking case of epitaxy under conditions of extremely limited surface mobility was thus observed at a stage only a little beyond that at which the initial nuclei originate from chemisorption. Anodic BeO layers, formed in a nitric-chromic acid solution, grew at a constant rate up to several thousand A thickness, with a linear current/voltage relationship. The initial very thin BeO layers were amorphous, but on reaching a thickness of 100-150 A and subsequently, the surface consisted of randomly disposed BeO crystals, 60 A or more in dia., indicating that in this and similar cases the surface temperature of the growing deposit considerably exceeds 300°C. A.

539.27 : 548.74 : 537.533.35

8989. ON THE INFLUENCE OF THE SHAPE OF THE NICKEL POINT ON THE ELECTRON IMAGE IN THE MULLER MICROSCOPE. R.Meclewski and Ł.Wojda.
Acta phys. Polon., Vol. 24, No. 6, 501-3 (1955).

By using a nickel point in a Müller point-emission microscope, it is shown that geometry can play a decisive part in determining the image pattern from a crystal. The effect of change of geometry caused by surface migration of atoms causes pattern changes which may be much more significant than the effects of varying work function or differential adsorption. M.E.Haine

ELASTICITY. STRENGTH. RHEOLOGY 539.3/.8

539.319

8990. RESIDUAL STRESSES AFTER THE POLISHING OF METALS. O.G.Karpinskiĭ and B.M.Levitskiĭ.
Dokl. Akad. Nauk SSSR, Vol. 106, No. 1, 55-7 (1956). In Russian.

Samples of iron and of aluminium are subjected to grinding or polishing of the surface. Graphs of "residual stresses" are presented which are said to have been derived from analysing the spectrum of scattered cobalt K_α-radiation. No particulars are given, either with respect to the observed X-ray spectrum, or with respect to the conversion of X-ray data to stresses. R.Eisenschitz

539.32

8991. DYNAMIC PROPERTIES OF VARIOUS RUBBERS AT HIGH FREQUENCIES. J.R.Cunningham and D.G.Ivey.
J. appl. Phys., Vol. 27, No. 9, 967-74 (Sept., 1956).

The shear-wave velocity and attenuation of GR-S, Butyl, Hevea, Hycar and Paracril rubbers have been measured in the frequency range 0.2-7 Mc/s sec and the temperature range −60°C to 20°C. To minimize errors arising from interfaces in the acoustic path, a double path technique was used. By combining the shear-wave data with bulk-wave data the dynamic shear, bulk and Young's moduli, and their associated viscosities, were calculated. The results were coupled with low-frequency Young's modulus data on the same materials to give information over many decades of logarithmic frequency, and from this the distribution of relaxation times was determined. To a fair approximation, in the range investigated, it was found that the real and imaginary parts of the dynamic Young's modulus could be taken as equal to three times the corresponding values of the dynamic shear modulus. It was found that the classical Stokes assumption, that the bulk viscosity is negligible in comparison to the shear viscosity, was reasonable for some of the rubbers, but not for all of them. A.

539.32

8992. ELASTIC CONSTANTS OF POROUS MATERIALS, ESPECIALLY OF $BaTiO_3$ CERAMICS. M.Marutake and T.Ikeda.
J. Phys. Soc. Japan, Vol. 11, No. 8, 814-18 (Aug., 1956).

The effective elastic constants of porous materials are calculated on the assumption that spherical pores are dispersed uniformly, and are compared with observed values of $BaTiO_3$ ceramics sintered at different temperatures. The agreement of the calculations with the experiments is not very good, and the form factors of pores are discussed. A.

539.32 : 537.228.1 : 537.226.2

A CALCULATION OF PHYSICAL CONSTANTS OF CERAMIC BARIUM TITANATE. See Abstr. 8169

539.374

8993. THE FLOW OF POLYVINYLCHLORIDE UNDER THE EFFECT OF STRONG FORCES. V.A.Kargin and T.I.Sogolova.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 4, 662-4 (1956). In Russian.

In this paper conclusions are summarized which are derived from a number of different observations and experiments. Heat treatment of polyvinylchloride results in the formation of a net of crosslinks between chain molecules, as revealed by diminishing solubility and increase in work hardening which brings flow under constant stress to a standstill. On the other hand the same material behaves in the process of rolling like a highly viscous fluid and rolled polyvinylchloride retains part of its solubility. It is concluded that the spontaneous formation of crosslinks is partly counteracted by the high stresses associated with the process of rolling so that existing links are broken. R.Eisenschitz

539.374

8994. EFFECT OF STRAIN RATE ON THE PROPAGATION OF A PLASTIC STRAIN PULSE ALONG A LEAD BAR. B.E.K.Alter and C.W.Curtis.
J. appl. Phys., Vol. 27, No. 9, 1079-85 (Sept., 1956).

Tests have been carried out to determine how pulses of plastic deformation disperse during propagation along a lead bar. Step function loading was employed in order to avoid complications resulting from the presence of relief stresses. By using a double pressure step technique, it was shown that the dispersion cannot be due solely to the nonlinearity of a time-independent stress–strain relation. On the other hand even a very simple model of a metal exhibiting a strain-rate effect serves to predict qualitatively all of the main features of the experimental observations. It is therefore concluded that in the case of lead a strain-rate effect plays an important part in controlling the behaviour of a plastic strain pulse. A.

539.374

8995. ON UNIQUENESS IN THE THEORY OF PLASTICITY. D.C.Drucker.
Quart. appl. Math., Vol. 14, No. 1, 35-42 (April, 1956).

The fundamental definitions of work-hardening and perfect plasticity have far reaching implications with respect to uniqueness of solution for elastic–plastic bodies. Satisfaction of the basic postulate, that in a cycle work cannot be extracted from the material and the system of forces acting upon it, guarantees an existing solution to be stable but not necessarily unique. Uniqueness follows for the usual linear relation between the increments or rates of stress and strain and also for combinations of such linear forms. Conversely, lack of uniqueness results for an elastic–perfectly plastic body when, for example, the maximum shearing stress criterion of yield is employed with the Mises flow rule. A.

539.374

8996. CONTINUUM THEORY OF DISLOCATIONS. E.Kröner and G.Rieder.
Z. Phys., Vol. 145, No. 4, 424-9 (1956). In German.

Discusses dislocations and the plastic deformation of crystals on the basis of classical plasticity theory. The "dislocation flow", equivalent to the sum of Burgers vectors, is expressed in terms of a tensor representing the dislocation density. E.P.Wohlfarth

539.42

8997. EXPERIMENTS ON THE INVESTIGATION OF THE FRACTURE OF NaCl CRYSTALS. N.M.Melankholin and V.R.Regel'.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 817-21 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 696-702 (July, 1956).

Development of cracks during the stretching of specimens of NaCl monocrystals was studied by the method of cinematography in polarized light. It was shown that the cracks spread intermittently. The development of the cracks is prevented by shearing bands which they have to cross. It is assumed that the propagation of the cracks is prevented by the regions of shearing bands in which compression stresses are present. The regions of shearing bands with stretching stresses apparently do not prevent their development. A.

539.576

8998. SURFACE FILM FORMATION AND METALLIC WEAR. W.Hirst and J.K.Lancaster.
J. appl. Phys., Vol. 27, No. 9, 1057-65 (Sept., 1956).

The interactions between surface asperities which occur during sliding are of primary importance in both friction and wear. In consequence, many of the phenomena observed during investigations into the nature of friction should have their counterpart in wear. An experimental study is described of the way in which wear is affected by factors already known to influence friction. It is shown that when a relatively soft metal slides on a harder one, the relationship between the wear and the sliding distance may be one of three general types. Each type is associated with the formation of a surface film during sliding. The extent to which these films (oxide, adsorbed boundary lubricant, etc.) prevent intermetallic contact influences the relationship between the wear rate and the applied load. With several metals there is a discontinuity in the wear-rate–load relationship, and two distinct regimes of wear are obtained. The transition between these two regimes is associated with the breakdown of a protecting surface film. Finally, it is suggested that the generation of protective surface films during sliding comprises an essential part of the "running-in" process of machinery. A.

PHYSICAL CHEMISTRY 541

PHASE EQUILIBRIUM. CHEMICAL REACTIONS 541.11/.12

541.115 : 536.423.1

CHEMICAL REACTIONS IN B—B_2O_3 SYSTEM AT 1300-1400°K. See Abstr. 8732

541.118

8999. FILTER-BOMB SAMPLING TECHNIQUE FOR PHASE EQUILIBRIA AT HIGH TEMPERATURE, PRESSURE. R.M.Bidwell, W.R.Wykoff and B.J.Thamer.
Nucleonics, Vol. 14, No. 7, 66-72 (July, 1956).

Constructional details of a sampling system using a platinum filter permanently pressed into a recess inside the cap of the bomb. Operating procedures described have been used successfully with corrosive acids at temperatures up to 600°C and pressures up to 20 000 lb/in². Included are design details for bomb seals and joints for hypodermic tubing. R.D.Smith

541.123.2

9000. SUPERCOOLING IN A BINARY LIQUID MISCIBILITY-GAP SYSTEM. R.A.Oriani.
J. chem. Phys., Vol. 25, No. 1, 186 (July, 1956).

Describes experiments on the difference between the separation and homogenization temperatures of the system CCl_4—C_7F_{14}, whose equilibrium diagram shows two coexisting phases separated by a miscibility gap. The advantage of this type of experiment in testing theories of nucleation of a precipitate is that when one liquid phase is precipitated from another the interfacial free energy is not complicated by questions such as coherency and orientation of the parent-phase and the precipitate. L.G.Carpenter

541.124 : 536.46

9001. DISSOCIATION ENERGIES OF OXIDES OF Mg, Ca, Sr AND Ba. I.V.Veĭts and L.V.Gurevich.
Optika i Spektrosk., Vol. 1, No. 1, 22-33 (1956). In Russian.

The dissociation equilibrium constants have been determined from a study of atomic resonant line intensities for oxides of the alkaline earth metals in flames of C_2H_2 + air, $C_2H_2 + O_2$, H_2 + air, $H_2 + O_2$. C.R.S.Manders

541.126

9002. MECHANISM OF THE INTERACTION OF OXYGEN ATOMS WITH OLEFINS. R.C.Cvetanović.
J. chem. Phys., Vol. 25, No. 2, 376-7 (Aug., 1956).

In the reaction of oxygen atoms with butenes little decomposition occurs, the products consisting mainly of epoxides and their isomers. These were analysed, and their relative amounts in reactions with butene-1, iso-butene, cis-butene-2 were determined. The ratios of rate constants of two compounds requiring oxygen atoms could also be found. J.Jacobs

541.126 : 536.46

9003. EFFECT OF ISOTOPIC SUBSTITUTION IN HYDROGEN BROMINE FLAMES. M.Gilbert and D.Altman.
J. chem. Phys., Vol. 25, No. 2, 377-8 (Aug., 1956).

It is shown that the flame equations based on steady state theory predict the experimental value of the ratio of the flame speeds in H_2/Br_2 and D_2/Br_2 mixtures. W.Good

541.126

9004. STUDY OF THE PROTOLYSIS OF METHYLAMMONIUM ION IN WATER BY PROTON MAGNETIC RESONANCE. E.Grunwald, A.Lowenstein and S.Meiboom.
J. chem. Phys., Vol. 25, No. 2, 382-3 (Aug., 1956).

Proton magnetic resonance spectra at 31.65 Mc/s of 4.47 molar solutions of methylamine hydrochloride at different pH values in water are shown. Rate constants at various $[H^+]$ and $[CH_3NH_3^+]$ concentrations were measured from the broadening of the CH_3 quartet. Evaluation of the broadening of the water line indicates that more than two-thirds of the proton transfers involve water. A mechanism is proposed for the protolysis. W.Good

541.127 : 535.333

9005. RATE OF THE REACTION: $H + O_3 \rightarrow OH + O_2$. AN ANALYSIS OF A PRODUCT EMITTER FLAME. D.Garvin and J.D.McKinley, Jr.
J.chem. Phys., Vol. 24, No. 6, 1256 (June, 1956).

The near infrared emission of OH was photographed, and an analysis was made of the shape of the emitter density profile. The theoretical model was based on the same assumptions as in the temperature pattern method. Two possible interpretations are discussed; in the more reasonable one reaction occurs upon every collision, with an average life for vibrationally excited OH* of 8×10^{-5} sec. J.Jacobs

541.127

9006. ANALYSIS OF FLAME-TRAVERSE STUDIES WITH GAS-SAMPLING PROBES. R.Friedman.
J. chem. Phys., Vol. 24, No. 6, 1268 (June, 1956).

In withdrawing gas samples from the reaction zone of stationary laminar pre-mixed gaseous flames, the fraction z_i contributed by the i^{th} species to the total flow may differ from y_i, the mole fraction. The calculated reaction rate is however the same for y_i or z_i even with large diffusion flow, if the i^{th} species disappears at a rate proportional to y_i. J.Jacobs

541.127

9007. EYRING RATE EQUATION AND THE TEMPERATURE DEPENDENCE OF SOLVOLYTIC REACTIONS. R.E.Robertson.
J. chem. Phys., Vol. 25, No. 2, 375-6 (Aug., 1956).

It is shown that the Eyring rate equation, in the form usually employed, in which the heat of activation is assumed to be temperature-independent, actually represents the temperature-dependence of the rate rather less well than the Arrhenius equation, for ionogenic reactions in solution. R.C.Murray

541.127.3

9008. TEMPERATURE EFFECTS IN THE LIQUID EXPLOSIVE, NITROMETHANE. A.W.Campbell, M.E.Malin and T.E.Holland.
J. appl. Phys., Vol. 27, No. 8, 963 (Aug., 1956).

The temperature coefficient of the detonation velocity in liquid nitromethane is much higher than has been previously realized, and is −3.7 m per sec per deg C. R.C.Murray

541.127.4 : 536.7

9009. MEASUREMENT OF EQUILIBRIUM OF THE REACTION: $TiCl_3(s) + HCl(g) \leftrightharpoons TiCl_4(g) + 1/2H_2(g)$. W.F.Krieve and M.Mason.
J. chem. Phys., Vol. 25, No. 3, 524-5 (Sept., 1956).

Equilibrium in the $TiCl_3(s) - HCl(g)$ system was studied in the temperature range 350 to 475°C by measuring the total pressure in an isochoric vessel. The equilibrium data for the above reaction in this temperature range is given by $\log_{10}K(\text{atmos}) = (-2.27 \times 10^3/T) + 1.82$. From these data, the enthalpy and entropy of reaction at the average temperature of about 690°K are 10.4 ± 0.4 kcal and 17.5 ± 0.5 cal/deg, respectively. From an estimated value for the ΔC_p of reaction, the enthalpy and entropy of reaction at 25°C are estimated to be 12.7 ± 1.0 kcal and 22.5 ± 2.0 cal/deg, respectively. The difference between the enthalpies of formation of $TiCl_3(s)$ and

$TiCl_4(l)$ is 19.0 ± 1.0 kcal/mole at 25°C. The equilibrium is shifted toward $TiCl_4(g)$ and $H_2(g)$ with increase in temperature, and at 25°C the reduction of $TiCl_4(g)$ by $H_2(g)$ to give $TiCl_3(s)$ is nearly complete, although the rate of the reaction is very low. A.

ELECTROCHEMISTRY 541.13

541.135 : 537.523.4

9010. ON THE DIFFICULTY OF PROVING THAT THE PROTON IS EJECTED FROM AN ELECTROLYTIC SOLUTION BY THE CATHODIC DISCHARGE. L.H.Collet.
J. Phys. Radium, Vol. 17, No. 3, 309-10 (March, 1956). In French.

A review of the results of experiments on the electrolysis of solutions by sparks leads to the question whether hydrogen ions may be liberated from the surface of the electrolyte (by electronic bombardment or photoeffect) in a cathodic discharge. J.Dutton

541.135

9011. AMERICIUM ELECTRODEPOSITION. R.Ko.
Nucleonics, Vol. 14, No. 7, 74 (July, 1956).

Americium was electrodeposited quantitatively from a formic-acid-ammonium formate solution on stainless steel, platinum and copper cathodes at a current density of 50-65 mA/cm^2. Full details of the process are given. R.D.Smith

541.135.3 : 539.155.2

9012. ISOTOPIC ENRICHMENT OF CHLORINE BY ELECTROLYTIC TRANSPORT IN MOLTEN ZINC CHLORIDE. A.Lundén and W.Herzog.
Z. Naturforsch., Vol. 11a, No. 6, 520-21 (June, 1956). In German.

The experimental conditions of the electrolysis in the apparatus used for other halides (Abstr. 7463/1955, 6096/1956) are described. The relative difference in migration velocity and the mass effect were found to be 0.00241 and -0.043 ± 0.003 respectively. The latter is thus smaller than that (−0.052 ± 0.003) of chlorine in lead chloride. W.Good

541.135.5

9013. STANDARD ELECTRODE POTENTIAL OF THE SILVER, SILVER CHLORIDE ELECTRODE. R.G.Bates, E.A.Guggenheim, H.S.Harned, D.J.G.Ives, G.J.Janz, C.B.Monk, R.A.Robinson, R.H.Stokes and W.F.K.Wynne-Jones.
J. chem. Phys., Vol. 25, No. 2, 361 (Aug., 1956).

Since this is uncertain to the extent of 0.2 mV it is suggested that each worker determine the E^0 value of his own set of electrodes by standardization in HCl of 0.01 molality for which γ_{HCl} be taken as 0.904 and 0.908 at 25° and 0°C respectively. W.Good

PHOTOCHEMISTRY. RADIATION CHEMISTRY 541.14/.15

541.14 : 535.89

9014. SAPPHIRE LAMP FOR SHORT WAVELENGTH PHOTOCHEMISTRY. L.S.Nelson.
J. Opt. Soc. Amer., Vol. 46, No. 9, 768-9 (Sept., 1956).

A flash lamp is made from a single boule of synthetic sapphire, bored out with diamond dust and with electrodes sealed into position on each end. Using an argon filling, emission down to 1540 A is obtained. Many practical details are given of the manufacture of the lamp, and a sample spectrogram is shown. R.W.Fish

541.14

9015. FLASH PHOTOLYSIS EXPERIMENTS WITH A SAPPHIRE FLASH LAMP. L.S.Nelson and D.A.Ramsay.
J. chem. Phys., Vol. 25, No. 2, 372 (Aug., 1956).

See preceding abstract. Flash photolysis of HCN at a few mm Hg pressure, using this lamp, gave the (0, 0) band of the CN radical in absorption at 3883 A. The rotational temperature of the bands approximated to room temperature and the radicals were not appreciably excited vibrationally. Free radicals were not observed during the flash photolysis of other molecules (e.g., CH_3CN, H_2O). This may have been due to the short absorption path or to the limited energy which could safely be discharged through the lamp. C.E.King

541.14 : 535.343

9016. ABSORPTION SPECTRA OF FREE RADICALS PRODUCED BY FLASH DISCHARGES. L.S.Nelson and D.A.Ramsay.
J. chem. Phys., Vol. 25, No. 2, 372-3 (Aug., 1956).

Evidence is given which suggests that the free radicals described in the preceding abstract may have been produced by flash discharges rather than by photolysis. This was confirmed by replacing the lamp by two electrodes, when the spectra were again obtained. The method was examined, using several other gases, with similar results. It is suggested that the use of condensed discharges of very short duration could provide a useful method for obtaining the spectra of the more stable free radicals. C.E.King

541.15 : 539.172.4

9017. RADIATION STABILITY OF POLYPHENYLS. E.L.Colichman and R.H.J.Gercke.
Nucleonics, Vol. 14, No. 7, 50-4 (July, 1956).

Terphenyls suitable for use as coolants and moderators for nuclear reactors were irradiated with 1 MeV electrons at 30, 275 and 350°C and the extent of their decomposition measured; o-, m-, and p-terphenyl biphenyl, p-quaterphenyl and several mixtures of these compounds were tested at doses up to 100 watt-hrs/g, and G-values (molecules formed per 100 eV absorbed) found for formation of polymer and gases. The amount of gas (mainly hydrogen) evolved is considered to be a good measure of the radiation stability of the compounds. The most stable substance was p-terphenyl; it was found that the stability of the mixtures tended towards the stability of the most stable component. Some additional tests with neutron and γ-ray irradiation confirmed that the radiation damage depends on the total energy absorbed and not on the type of radiation. R.D.Smith

DISPERSIONS. COLLOIDS. ADSORPTION 541.18

541.183

9018. CHEMISORPTION DATA AND THE ELOVICH EQUATION. J.N.Sarmousakis and M.J.D.Low.
J. chem. Phys., Vol. 25, No. 1, 178-9 (July, 1956).

A numerical method for the evaluation of the parameters of the Elovich equation from available experimental data on chemisorption is given. P.T.Landsberg

CHEMICAL STRUCTURE 541.2/.6

541.57

9019. HYDROGEN BONDING IN THE THIOL GROUP. A.Menefee, D.Alford and C.B.Scott.
J. chem. Phys., Vol. 25, No. 2, 370-1 (Aug., 1956).

Infrared spectra of $(CH_3O)_2PSSH$ and $(C_2H_5O)_2PSSH$ provide evidence for the existence of S.....H—S rather than O.....H—S hydrogen bonds in these compounds. The —SH stretching frequency is lowered by 140 cm^{-1}. G.Allen

541.57

9020. POLARIZABILITY OF THE HYDROGEN BRIDGE. A.N.Baker.
J. chem. Phys., Vol. 25, No. 2, 381 (Aug., 1956).

The quantum mechanical treatment of the hydrogen bridge shows that each energy level of the unperturbed X—H system is split into two levels. The results of approximate calculations of the splitting for O—H——O and O—D——O as a function of bridge length are presented graphically. An expression for the polarizability is derived assuming a two level system. G.Allen

541.62

9021. ON THE DYNAMIC EQUILIBRIUM OF INVERTED ISOMERS IN THE SOLID STATE. K.Kozima and K.Sakashita.
J. chem. Phys., Vol. 25, No. 1, 177-8 (July, 1956).

Measurements of the infrared spectrum of 1,2-di chloro-4,5 di bromocyclohexane at temperatures between 98° and 435°K indicate an equilibrium between two isomers which varies with temperature. Calculated values of the equilibrium composition and the interchange energy are listed for the several temperatures. G.F.Lothian

541.62

9022. OBSERVATION OF THERMAL ISOMERIZATION BY N.M.R. SPECTROSCOPY. A.G.Whittaker and D.W.Moore.
J. chem. Phys., Vol. 25, No. 2, 366-7 (Aug., 1956).

The isomerization of 5-ethylaminotetrazole in concentrated solution in D_2O is followed at 160°C by observing the effect of changing molecular structure on the proton resonance lines. An unsuccessful attempt is made to observe the reaction intermediates. G.Allen

541.64 : 539.213

9023. NATURE OF THE GLASS TRANSITION IN POLYMERS. J.H.Gibbs.
J. chem. Phys., Vol. 25, No. 1, 185-6 (July, 1956).

A tetrahedal lattice model is considered for a bulk polymer phase and an expression for the number of configurations (W) available to the system is obtained. As the temperature falls the free volume decreases and the chains stiffen, causing W to fall towards unity. The temperature at which W falls to unity is identified as the glass transition for noncrystallizing polymers. G.Allen

541.651

9024. COLOR IN OLEFIN SULFURIC ACID SYSTEMS. J.Gonzalez-Vidal, E.Kohn and F.A.Matsen.
J. chem. Phys., Vol. 25, No. 1, 181 (July, 1956).

Spectroscopic and analytical evidence shows that the colour is due to oxidation processes and not to the formation of carbonium ions. G.Allen

CHEMICAL ANALYSIS 543/545

545.824

9025. MICRO-ANALYSIS BY A FLYING-SPOT X-RAY METHOD. V.E.Cosslett and P.Duncumb.
Nature (London), Vol. 177, 1172-3 (June 23, 1956).

A point focus of electrons, produced by magnetic electron lenses, is scanned across the surface of a specimen in vacuum. The electron probe has a diameter of 1 micron. The emitted X-rays are recorded by two separate counter systems. A scintillation counter responds to all wavelengths, delivering a signal to a cathode-ray tube scanned in synchronism with the electron probe, so that a picture is displayed of the part of the surface scanned. A proportional counter and crystal spectrometer are used to analyse the X-ray spectrum, so that particular elements are detected by their characteristic line emission. Direct quantitative results for the concentrations of different elements are obtained. In this way impurities in a beryllium foil have been identified, as an example of the usefulness of the method. V.E.Cosslett

CRYSTALLOGRAPHY 548

548.233 : 539.231

THE STRUCTURE OF THIN IRON FILMS DEPOSITED BY EVAPORATION IN VACUO. See Abstr. 8987

548.5 : 548.7

9026. THE MEASUREMENT OF GROWTH AND DEFORMATION FAULTING IN HEXAGONAL COBALT. T.R.Anantharaman and J.W.Christian.
Acta cryst., Vol. 9, Pt 6, 479-86 (June, 1956).

The use of Fourier and line-breadth methods for the determination of stacking-fault parameters in hexagonal close-packed metals has been investigated. Greatest accuracy is probably obtained by Fourier analysis of the $\{10\bar{1}1\}$ line, but analyses of other lines are required in addition when more than one type of faulting is present. Line-breadth methods usually give satisfactory results, and are valuable in determining the predominant type of faulting. Spontaneously transformed cobalt powders often contain mainly growth faults, whereas specimens which have been deformed to complete the martensitic transformation contain mainly deformation faults. Specimens with mixed faulting have also been obtained; an alternative hypothesis, that the faults are "clustered", will explain the line-breadth results, but not those obtained by Fourier analysis. A.

548.5 : 535.37

9027. NEW CONTRIBUTIONS TO THE PHYSICS OF CRYSTALS. Z.Gyulai.
Acta phys. Hungar., Vol. 5, No. 4, 425-43 (1956). In German.

The following studies are presented as new contributions to the physics of crystal growth :- (1) the growth of crystals from fixer salt solution ($Na_2S_2O_3$), recorded by moving film technique, showing an adherence to the Kossel rule; (2) observations on needle-form crystals plastically deformed which show recrystallization at various controlled temperatures; (3) study of the plastic bending of NaCl needles, the solubility increasing in the plastically deformed region. Phosphors of thallium activated alkali halides are also described which are produced by pressure fusion of the constituents into pastille form. Formation at elevated temperatures gives rise to F-centre formation. G.F.J.Garlick

548.5

9028. TECHNICAL REMARKS ON THE GROWTH OF SINGLE CRYSTALS FROM THE MELT. I.Tarján and G.Turchányi.
Acta Phys. Hungar., Vol. 5, No. 4, 533-5 (1956). In German.

To ensure strain free growth of NaI(Tl) single crystals by the Bridgman method, the crucible is shaped to facilitate freeing of the crystal from the walls by surface melting. With the Kyropoulos method, it is desirable to rotate the crucible rather than the seed, and to maintain low temperature gradients at the surface of the melt. J.Franks

548.5

9029. APPARATUS FOR THE LABORATORY PRODUCTION OF GERMANIUM CRYSTALS. Z.Trousil.
Czech. J. Phys., Vol. 6, No. 1, 91-4 (Jan., 1956). In Russian.

An illustrated description of zone melting and crystal pulling apparatus. Zone melting was carried out in high vacuum. Electron bombardment of the graphite boat containing the Ge was used to form the zone, 300-500 W at 5-7 kV being required. After 6-8 zone passes 80% of the 150 g charge (initially 0.02 ohm. cm) was 30-50 ohm. cm. In the pulling apparatus the quartz crucible and tungsten wire heaters were set in a large graphite block to ensure extremely even heat flow. Photographs of pulled crystals 2 cm in diameter and about 120 g in weight are shown. C.H.L.Goodman

548.5

9030. FORMATION OF MIXED CRYSTALS IN THE USE OF THE ALKALI-HALIDE DISK TECHNIQUE FOR PREPARING SAMPLES OF $KAu(CN)_2$ FOR INFRARED SPECTRA. L.H.Jones and M.M.Chamberlain.
J. chem. Phys., Vol. 25, No. 2, 365-6 (Aug., 1956).

With KBr and KI disks, but not with KCl, the initial bands at 2141 and 427 cm^{-1} diminish in intensity for about an hour and bands at 2154 and 448 grow; these are attributed to mixed crystals with N-C-Au-C-N replacing a Br-K-Br chain. G.F.Lothian

548.5 : 539.27 : 539.232

THE STRUCTURE AND GROWTH OF OXIDE LAYERS FORMED ON BERYLLIUM. See Abstr. 8988

548.522

9031. VAPOR PHASE CRYSTAL GROWTH OF GERMANIUM FROM THERMALLY DECOMPOSED GERMANE. M.Davis and R.F.Lever.
J. appl. Phys., Vol. 27, No. 7, 835-6 (July, 1956).

A constant volume apparatus, in which the pressure of liberated H rose slowly, and a constant flow apparatus were used. Four types of crystal growth were observed, (1) separate growths bounded by {111} facets above 900° C, orientation same as substrate, (2) growth of {110} facets on a {110} surface below 880° C, (3) whisker growth, in constant flow apparatus, random orientation independent of substrate, (4) pinnacle growth, in constant volume apparatus. J.Franks

548.55

9032. INVESTIGATION OF THE STRUCTURE OF THE SURFACE OF FILMS OF COPPER OXIDE ON DIFFERENT FACES OF A MONOCRYSTAL OF COPPER AND THE DETERMINATION OF THE CONTACT POTENTIAL DIFFERENCE BETWEEN THESE SURFACES. N.B.Gornyĭ.
Zh. éksper teor. Fiz., Vol. 29, No. 6(12), 808-16 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 687-95 (July, 1956).

The structure of the surfaces of films of copper oxide formed on various faces of a monocrystal of copper is investigated using the method of diffraction of slow electrons. It is found that on faces (100) and (111) of a monocrystal of copper there forms a monocrystalline film of Cu_2O with a (111) plane parallel to the base. On face (110) a monocrystalline film of Cu_2O is also formed but with a less perfect crystalline structure and with a (110) surface plane. Investigation of the contact potential difference by the method of displacement of the volt–ampere characteristic curves demonstrated that the films of Cu_2O on faces (100) and (111) of a monocrystal of copper have the same work function (0.2 V), and consequently, have the same crystalline orientation. The film of Cu_2O on the (110) face of copper possesses a larger work function (0.3 V), and also has stronger adsorptivity of residual gases than the films of Cu_2O on faces (100) and (111), which indicates a difference between the properties (orientations) of the film of Cu_2O on face Cu (110) and of the films of Cu_2O on faces Cu (100) and (111). A.

ATOMIC AND X-RAY CRYSTALLOGRAPHY 548.7

548.7

9033. NUMBER OF VACANCIES CREATED BY HEAVY CORPUSCULAR RADIATION. J.Neufeld and W.S.Snyder.
Phys. Rev., Vol. 99, No. 4, 1326 (Aug. 15, 1955).

The methods of the authors' earlier paper (Abstr. 4827/1955) are applied to the idea of replacement collisions. It is found that the number of vacancies produced may be only about 2/3 the number of atoms displaced. This reduces the calculated value of resistivity of Cu irradiated with 17 MeV deuterons from 5 times the observed value to 3.3 times. W.M.Lomer

548.7 : 539.152.1

9034. NUCLEAR QUADRUPOLE RESONANCE OF γ-IRRADIATED PARA-DICHLORBENZENE. J.Duchesne, A.Monfils and J.Garsou.
J. chem. Phys., Vol. 23, No. 10, 1969 (Oct., 1955).

In $p\text{-}C_6H_4Cl_2$ crystals damaged by irradiation with 1.4×10^8 r from Co^{60} γ-rays, the quadrupole resonance signal weakens by 25%, indicating that about 1 in 10^3 imperfection centres have been formed. D.H.Whiffen

548.7

9035. APPLICATION OF THE ORTHOGONALIZED PLANE-WAVE METHOD TO SILICON CRYSTAL. T.O.Woodruff.
Phys. Rev., Vol. 103, No. 5, 1159-66 (Sept. 1, 1956).

Approximate solutions for k = 0 of the Hartree–Fock–Slater equations for a perfect silicon crystal have been obtained by the orthogonalized plane-wave method. Estimates of the energy eigenvalues of the valence and conduction states for k = 0 are given. A simple method for obtaining a first approximation to the crystal potential and its Fourier coefficients was used. Approximate analytic wave-functions and corresponding energy eigenvalues for the 1s, 2s and 2p states in the isolated silicon atom were determined by a variational technique. A.

548.7

9036. ON ORDER–DISORDER STRUCTURES (OD-STRUCTURES). K.Dornberger-Schiff.
Acta cryst., Vol. 9, Pt 7, 593-601 (July, 1956).

Certain features common to structures with one-dimensional position disorder and to related ordered layer structures (OD-structures) are discussed, the corresponding concepts are introduced by examples and the corresponding features of Fourier transforms are deduced. OD-structures are systematized and a glossary of terms is added. In an Appendix a nomenclature for plane space groups in three dimensions, which corresponds to the international nomenclature for three-dimensional space groups, is suggested. A.

548.7

9037. OBSERVATIONS OF DISLOCATION GLIDE AND CLIMB IN LITHIUM FLUORIDE CRYSTALS. J.J.Gilman and W.G.Johnston.
J. appl. Phys., Vol. 27, No. 9, 1018-22 (Sept., 1956).

It is shown that reagent CP-4 plus ferric ions can be used to detect the positions of dislocations in LiF crystals. The technique is highly selective and both edge and screw (110) $[1\bar{1}0]$ dislocations can be detected and distinguished. A double etching method is used to observe, for the first time, the glide and climb of individual dislocations in LiF. A.

548.7

9038. OPTICAL INVESTIGATIONS OF LATTICE DEFECTS IN QUARTZ. B.Eckstein.
Z. Phys. Chem. (Leipzig). Vol. 204, No. 5-6, 357-68 (Aug., 1955). In German.

Optical absorption measurements in the tail of the fundamental band can give information on the number and energy levels of defects. In case of reversible defect form-

ation it gives fraction of defects as $n/n_0 = \exp(-\Delta E_0/2kt)$ where ΔE_0 is energy difference between normal lattice ion and displaced ion. It is assumed that absorption is proportional to defect concentration. The loose structure of quartz allows easy entry for foreign atoms and Joffé has shown that it is easy to induce Frenkel defects by ultraviolet or X-rays. Below 300° C irreversible defect formation predominates and the phase change at 572° C complicates matters so that only above 300° C can the exponential law be used. In addition, the appreciable reflection losses and their change with temperature below 800° C cannot be assessed. Curves are given showing relation of transmission to temperature with a number of different Hg lines. A distinct fundamental band-edge does not seem to exist but there is a gradual rise over a wide wavelength range. There is a distinct structure in the shorter wave part of the tail absorption (2000-2500 A) indicating preferred energy levels for defects. Successive heating and cooling between 500 and 1000° C shows complex changes in absorption corresponding to irreversible defect formation due to freezing in of Frenkel defects and changes of inner surface area as shown by Rexer (Z. Phys., 75, No. 11-12, 777-83/1932) for NaCl. A series of plots of log absorption v. 1/T gives about the same value for ΔE_0 for different wavelengths (1.5 eV). A decrease of slope of this plot just under the melting point indicates a decrease of ΔE_0 as expected. J.Ewles

548.7

9039. RADIATION DAMAGE IN DIAMOND AND SILICON CARBIDE. W.Primak, L.H.Fuchs and P.P.Day.
Phys. Rev., Vol. 103, No. 5, 1184-92 (Sept. 1, 1956).

Diamond and silicon carbide were irradiated in nuclear reactors and were found to be damaged in a manner similar to that for graphite. Detailed observations were made of the dilatation and increase in energy content and their annealing. Dilatations as great as about 3.7% and increases in energy content as great as about 400 cal/g were observed. The dilatations and the energy content (release of stored energy) seemed to anneal in a parallel manner and could be treated kinetically as a distribution of processes in activation energy. The initial distribution for diamond showed a peak at about 1.6 eV and a plateau extending (at about $\frac{1}{4}$ the height of the peak at short irradiations and greater proportionately for long irradiations) to activation energies in excess of 3.7 eV. The initial distribution for silicon carbide showed a smaller narrow peak at about 2.2 eV to 4.3 eV with a maximum at about 3.4 eV. In many of the samples of irradiated diamond the stored energy exceeded the heat capacity in certain temperature ranges, and catastrophic stored energy release was observed on heating. A.

548.7

9040. COLORATION OF ROCKSALT BY THE REXER METHOD. E.Boesman, G.Remaut and W.Dekeyser.
J. chem. Phys., Vol. 25, No. 2, 359-60 (Aug., 1956).

The additive coloration of rock salt, as produced at high temperatures by the Rexer method (for application to the location of dislocation networks see Abstract 5527/1956), has been found, in some specimens, to disappear on cooling. A stable coloration can, however, be obtained by previously heating such specimens in oxygen, nitrogen or argon provided that the temperature is not too low nor the pressure too high. Similar treatment in hydrogen produces no effect; neither does the incorporation of the divalent ions Ca^{2+}, Ba^{2+} or Sr^{2+} into the crystal. Ag^+ impurities do however lead to stable coloration. A.B.Lidiard

548.7

9041. PHOTOCHEMICAL CONVERSION OF COLOUR CENTRES IN HEATED CRYSTALS OF POTASSIUM CHLORIDE. A.A.Shatalov.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 847-56 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 725-32 (July, 1956).

The results of investigating the photochemical conversion of F-centres in KCl crystals at temperatures of 270-300° C, leading to the complete disappearance of absorption F-bands and their replacement by analogous symmetrical bell-shaped band (X-band) displaced by 0.5 eV towards the long wavelength region, are described. At lower temperatures 250-150° C), exposure to light similarly results in the complete disappearance of F-bands and their replacement by wider and lower symmetrical absorption bands somewhat displaced toward the long wavelength region. The temperature dependence of absorption X-bands is characterized by increasing height, narrowing, and displacement of the bands towards shorter wavelengths, upon cooling. Preliminary measurements of the kinetics of the photochemical conversion process of F-centres are reported for different temperatures. A hypothesis connecting the observed thermophotochemical F-centre conversions with the formation process of colloidal alkali metal is proposed. The possible mechanism of converting F-centres into F_2-centres under the influence of light is deduced. A.

548.7 : 537.311.33

THE ELECTRICAL PROPERTIES OF DISLOCATIONS IN GERMANIUM. See Abstr. 8188

548.7 : 537.533.2 : 535.37

COLOUR CENTRES IN X-RAY IRRADIATED IONIC CRYSTALS. See Abstr. 8685

548.7 : 539.11

ENERGY SPECTRUM OF AN ELECTRON IN A CRYSTAL IN A MAGNETIC FIELD. See Abstr. 8891

548.73/.74

X-RAY AND ELECTRON INVESTIGATION OF MATERIALS. See also under "Structure of solids". Decimal classification 539.26/.27

548.732

9042. X-RAY SCATTERING BY "NEON-LIKE" MOLECULES. K.E.Banyard and N.H.March.
Acta cryst., Vol. 9, Pt 4, 385-91 (April, 1956).

An attempt is made to interpret quantitatively the X-ray scattering results of Thomer for the series of "neon-like" molecules Ne, H_2O, NH_3 and CH_4. For Ne and CH_4 wave functions calculated by the Hartree self-consistent-field method are available and the X-ray scattering factors can be obtained from these. For H_2O and NH_3 new central-field analytical wave functions were calculated by setting up a total molecular wave function of determinantal form and applying the variational method. In both cases computations were made of the scattering factors to be expected from the densities thus obtained. In this way the general features of Thomer's experimental results are undeniably shown. The quantitative agreement for CH_4 is excellent and is still good for H_2O and NH_3. Everything points to the fact that if the central-field wave functions for H_2O and NH_3 were refined by making self-consistent-field calculations the agreement would be even better. A.

548.733

9043. A COMPARISON OF VARIOUS COMMERCIALLY AVAILABLE X-RAY FILMS.
Acta cryst., Vol. 9, Pt 6, 520-5 (June, 1956).

The speeds for Cu and Mo radiation, the fog density, the granularity, the absorption of Cu radiation, and the density versus X-ray exposure curve have been determined for forty-one commercially available types of X-ray film. The results are tabulated and a short description is given of the experimental procedure followed. A.

548.733

9044. THE INFLUENCE OF TOTAL REFLECTION FROM A SOLLER SLIT ON THE RESOLVING POWER OF AN X-RAY SPECTROGRAPH. J.Drahokoupil.
Czech. J. Phys., Vol. 6, No. 1, 35-8 (Jan., 1956). In Russian, with summary (200 words) in English.

Experiment showed that X-rays (Fe Kα) totally reflected

from the aluminium foils of a Soller slit could be suppressed by roughening the foils with emery. In the particular apparatus a 20% increase in resolving power was obtained.

A.L.Mackay

548.734

9045. CRYSTALLOGRAPHIC CALCULATIONS ON THE HIGH-SPEED DIGITAL COMPUTER SWAC. R.A.Sparks, R.J.Prosen, F.H.Kruse and K.N.Trueblood.
Acta cryst., Vol. 9, Pt 4, 350-58 (April, 1956).

The high-speed digital computer SWAC has been used extensively for calculations needed in the determination and refinement of crystal structures. Programmes for calculation of structure factors, normal Fourier summations, differential Fourier summations and least-squares refinement are described briefly, and some practical experience with them is discussed. In general these programmes may be used with only minor specified changes for almost any crystal of any symmetry. All programmes include provision for use of individual anisotropic atomic temperature factors. A few other programmes for more trivial, but nevertheless tedious, calculations are also described. A.

548.735.46

9046. A MODIFIED PATTERSON FUNCTION. J.M.Cowley.
Acta cryst., Vol. 9, Pt 4, 397-8 (April, 1956).

If the Fourier coefficients $|F_h|^2$ of a Patterson function are replaced by a power series in $|F_h|^2$, which is approximately proportional to $|F_h|$ over a limited range, the resulting modified Patterson function is sharpened and the smaller vector peaks are emphasized. This facilitates the interpretation of the Patterson function in some cases. As an example, modified and unmodified Patterson projections of basic lead carbonate are compared. A.

548.736.1 : 536.413

9047. LATTICE PARAMETER AND COEFFICIENT OF THERMAL EXPANSION OF THORIUM. W.J.James and M.E.Straumanis.
Acta cryst., Vol. 9, Pt 4, 376-9 (April, 1956).

Values of the lattice parameter of 99.86% pure thorium were determined by the asymmetric method over the temperature range +10 to +60° C, using copper radiation. A value of 5.0741 ± 0.0001 kX (5.0843 A) at 25° C, corrected for refraction, was obtained. The precision of the determination was better than 1 : 60 000. The computed closest atom-to-atom distance was 3.5952 A. The linear expansion coefficient was 11.6×10^{-6} $(^\circ C)^{-1}$ for 10-60° C. The expansivity curve suggested some transition in the region of 38° C but no definite conclusion could be drawn. The calculated X-ray density at 25° C was 11.724 ± 0.004 g/cm^{-3}. A.

548.736.1

9048. X-RAY STUDY OF THE ALLOTROPIC MODIFICATIONS OF CALCIUM METAL. H.Melsert, T.J.Tiedema and W.G.Burgers.
Acta cryst., Vol. 9, Pt 6, 525-7 (June, 1956).

It is shown by means of Debye–Scherrer phtographs that for the metal calcium three allotropic modifications occur, namely α-Ca, cubic face centred; β-Ca, hexagonal close packed; and γ-Ca, cubic body centred, the transition points lying at about 250° C and 450° C. The observed lattice constants of the three modifications are closely related to those of the analogous modifications of strontium. A.

548.736.1

9049. THE CRYSTAL STRUCTURE OF SOLID CHLORINE: CORRECTION. R.L.Collin.
Acta cryst., Vol. 9, Pt 6, 537 (June, 1956).
See Abstr. 7693 (1952).

548.736.3

9050. COMPOUNDS OF THORIUM WITH TRANSITION METALS. II. SYSTEMS WITH IRON, COBALT AND NICKEL. J.V.Florio, N.C.Baenziger and R.E.Rundle.
Acta cryst., Vol. 9, Pt 4, 367-72 (April, 1956).

The compositions of the compounds of thorium with iron, cobalt, nickel and copper were summarized in Pt 1 (Abstr. 7699/1952). Details of the structures of these compounds, together with a brief description of the structure determinations of the new structural types, are given here. Certain relationships among the compounds are noted. A.

548.736.4

9051. STRUCTURE OF $GeUO_4$. A.Durif.
Acta cryst., Vol. 9, Pt 6, 533 (June, 1956). In French.

548.736.5 : 535.343

THE INFRARED SPECTRUM AND CRYSTAL STRUCTURE OF GYPSUM. See Abstr. 8103

548.736.6 : 535.343

THE INFRA-RED SPECTRUM OF AFWILLITE, $Ca_3(SiO_3OH)_2.2H_2O$, IN RELATION TO THE PROPOSED HYDROGEN POSITION. See Abstr. 8102

548.74

9052. ELECTRON-DIFFRACTION STUDY OF THE STRUCTURE OF BASIC LEAD CARBONATE, $2PbCO_3.Pb(OH)_2$. J.M.Cowley.
Acta cryst., Vol. 9, Pt 4, 391-6 (April, 1956).

Previously established techniques and some new techniques, including the use of modified Patterson functions and the derivation of three-dimensional Patterson functions by a "stereoscopic" method, have been applied to the structure analysis of single crystals of basic lead carbonate by electron diffraction. The crystals have a disordered layer lattice and the structure was analysed by the "distribution-function" method. The individual layers have a trigonal unit cell, P31m with a = b = 9.06, c = 8.27 A, and contain a $Pb(OH)_2$ sheet sandwiched between two $PbCO_3$ sheets. On the average the layers have approximate rhombohedral stacking, giving c = 24.8 A, but the deviations from this are such that a fully-ordered structure would be triclinic, P1. The modification of the intensities by the difference in phase of electrons scattered from light and heavy atoms is calculated, and its importance in structure analysis is assessed. A.

GEOPHYSICS 55

550.341 : 534.2

PROPAGATION OF RAYLEIGH WAVES IN TRANSVERSELY ISOTROPIC MEDIUM IN THREE DIMENSIONS. See Abstr. 8626

550.38

9053. NOTE ON THE COMPONENTS OF MAGNETIC INTENSITY AT INVERSE POINTS RELATIVE TO A SPHERICAL BOUNDARY. A.J.Zmuda.
Trans Amer. Geophys. Un., Vol. 37, No. 3, 273-4 (June, 1956).

Equations are derived which govern the relation between the values of a field component at points that are inverse relative to a spherical boundary carrying the distribution of sources. Inversions are made for surface and double-layer distributions. The existence of simple relations of this character accompanies the existence of continuity of the component at the boundary. A.

550.384

9054. LONG-PERIOD VARIATIONS IN GEOMAGNETIC ACTIVITY. E.J.Chernosky.
Trans Amer. Geophys. Un., Vol. 36, No. 4, 591-5 (Aug., 1955).

The correlation shown by Bartels between annual means of the sunspot number and of the magnetic u figure is markedly improved when means of two longer periods are used. These are the fundamental solar periodicities —the 11-year sunspot-number and latitude cycle and the 22-year sunspot magnetism cycle. A plot of 11-year running means shows a 22-year variation not too evident in Bartels' annual means, and 22-year running means show a secular low at about 1900, with generally rising activity since then in both the objective u and the subjective C measures. Differences in u and C are ascribed more to evaluations of different regions of the magnetic time-variation spectrum than to inconsistencies of C. A.

550.389 : 525.3

9055. NONUNIFORM ROTATION OF THE EARTH AND GEOMAGNETIC DRIFT. W.M.Elsasser and H.Takeuchi.
Trans Amer. Geophys. Un., Vol. 36, No. 4, 584-90 (Aug., 1955).

The transmission of mechanical forces of the magnetic field through the top layers of the core and into the mantle is analysed. It is shown that moderate fluctuations of the toroidal field near the boundary of the core are adequate to produce the observed variations in the Earth's rate of rotation. A simple model of the boundary layer of the core is worked out and it is shown that the angular velocity, on going down from the boundary of the core, must first decrease and then increase again, in agreement with the observations on the westward drift and with the dynamo theory. A.

550.422 : 539.163

OCCURRENCE OF TECHNETIUM ON THE EARTH'S CRUST. See Abstr. 8341

550.837.6 : 538.52

9056. ELECTROMAGNETIC INDUCTION IN A TWO-LAYER EARTH. B.K.Bhattacharyya.
J. geophys. Res., Vol. 60, No. 3, 279-88 (Sept., 1955).

The problem of determining the induced field components outside a horizontal two-layer earth has been tackled from a theoretical point of view. The expressions obtained have been applied to evaluate the induced magnetic field due to an oscillating magnetic dipole on the surface of the earth. Two separate cases have been considered, for example, (i) two layers of nearly equal conductivities, and (ii) a conducting layer over an insulating medium, and the formulae have been reduced to a form amenable to numerical integration. A.

550.93 : 539.16

9057. RADIOACTIVE METHODS FOR DETERMINING GEOLOGICAL AGE. L.H.Ahrens.
Rep. Progr. Phys., Vol. 19, 80-106 (1956).

Research on the use of radioactive methods for determining the absolute ages of minerals, rocks and meteorites has developed with great vigour since World War II. Much of this expansion of application has been due to the introduction of a variety of sensitive and precise analytical procedures. The lead method remains the most highly developed of all methods, but difficulty of interpreting lead age distributions has been a major problem. Recent interpretation of these distributions on a basis of lead deficiency leads to the conclusion that most recommended lead ages are under-estimates and that the scale of geological time, now based on the lead method, should be expanded considerably. Investigations demonstrating the surficial concentration of uranium and thorium around mineral grains and within their cracks and fissures has been most helpful for the helium and lead methods. Several new methods are in various stages of development and those based on the radioactivity of rubidium and potassium appear to be the most promising. The simple nature of alkali metal radioactivity is a fundamental consideration in their favour. The strontium method, though still somewhat restricted in application, appears to be particularly satisfactory for determining the ages of very early pre-Cambrian minerals, whereas the argon method shows promise of wide application to common potassium minerals; uncertainty of the branching ratio β/e for K^{40} remains a problem. Long life of parents and other considerations seem to rule out the possibility of utilizing the radioactivity of several elements such as tellurium, bismuth, indium and samarium. Several possible indirect methods (radiation damage, thermoluminescence and cube edge variation) are being developed for the purpose of determining the geological age of a mineral, but have not been considered in this review. A.

551.16

9058. INTRODUCTION TO A DISCUSSION ON "MOVEMENTS IN THE EARTH'S CORE AND ELECTRICAL CONDUCTIVITY". E.C.Bullard.
Ann. Géophys., Vol. 11, No. 1, 49-52 (1955).

Introductory remarks to a series of papers (see abstracts following) read at the Rome Assembly of U.G.G.I. in September 1954. Movements in the earth's liquid core are suggested by the relatively rapid secular changes of the surface magnetic field, the westward drift of certain features of the field indicating the order of magnitude of the fluid motions involved. The supposed existence of these motions raises many questions about the mechanical, thermal and electrical properties of the earth's interior, which are discussed in the following papers of this series. A.T.Price

551.16

9059. PHYSICAL PROPERTIES OF THE EARTH'S CORE. K.E.Bullen.
Ann. Géophys., Vol. 11, No. 1, 53-64 (1955).

The pressure, temperature, elasticity and composition of the earth's interior are considered. The pressure ranges from near zero to 3 or 4 million atmospheres, and its effects on density and compressibility greatly outweigh those due to temperature changes. The ratio of the adiabatic incompressibility to density is inferred from seismic velocity data, and theoretical considerations lead to estimates of the density, pressure and incompressibility in the mantle and core. There is a sharp increase in the density gradient in the lowest 200 km of the mantle, the outer core is liquid and the inner core probably solid. The most probable composition of the outer core is a mixture of iron with material of lower atomic number, which may be a high-pressure modification of the material of the lower mantle. The inner core is composed of material whose atomic number is at least equal to that of iron, and it probably contains other materials of still higher atomic number. A.T.Price

551.16 : 523.51

9060. DISTRIBUTION OF ELEMENTS IN THE METEORITES AND THE EARTH, AND THE ORIGIN OF HEAT IN THE EARTH'S CORE. H.C.Urey.
Ann. Géophys., Vol. 11, No. 1, 65-72 (1955).

Thermochemical calculations relating to the distribution of various elements in the silicate, troilite and metallic phases of meteorites assuming equilibrium conditions at 2000° K, and comparison with observed concentrations, indicate that the concentrations of the radioactive elements, uranium, thorium and potassium in meteorites are no guide to their concentration in the earth's core. Further considerations suggest that uranium and thorium cannot be present in sufficient concentration to maintain an adiabatic gradient and produce convection currents, but potassium might be. Alternatively convection currents might arise from the progressive differentiation of earth material from a more to a less uniform chemical composition. A.T.Price

551.16 : 550.384.3

9061. CORE MOTIONS AND REVERSALS OF THE GEOMAGNETIC FIELD. S.K.Runcorn.
Ann. Géophys., Vol. 11, No. 1, 73-9 (1955).

Investigations of Icelandic lavas have revealed that the mean geomagnetic field over long geologic periods is closer to that of an axial dipole than is the present field, and the polarity of the field has reversed at intervals of about 10^5-10^6 years, with only comparatively short periods of transition. The approximate coincidence of the magnetic and geographic axes is probably due to Coriolis forces acting on the moving fluid to the core. The type of change in the core motions which would result in a reversal of the polarity of the geomagnetic field is discussed. A.T.Price

551.16

9062. THE SECULAR VARIATION PRODUCED BY CONVERGENCE OR DIVERGENCE AT THE SURFACE OF THE CORE. J.Coulomb.
Ann. Géophys., Vol. 11, No. 1, 80-2 (1955). In French.

A calculation is made on certain simplifying assumptions of the secular variation which would be produced by a diverging or converging flow of fluid at the surface of the core. The corresponding vertical flow at the centre of one of the sources or sinks required to give rise to observed secular variations is estimated to be of the order of several metres per second. A.T.Price

551.16 : 550.38

9063. THE SYNTHESIS OF EXTERNAL MAGNETIC FIELDS BY MEANS OF RADIAL INTERNAL DIPOLES. D.G.Knapp.
Ann. Géophys., Vol. 11, No. 1, 83-90 (1955).

The existence of two Arctic intensity foci shows that the single dipole representation of the major part of the earth's field, assumed to arise from electric currents in the core, needs modification to account for the Polar field. The hypothesis that one of the foci is produced by crustal irregularity has the weakness that the field patterns surrounding the two foci are quite similar. It appears that the origin of both foci must be sought in the core. The field patterns which would arise from two radial dipoles at a depth chosen to simulate horizontal current systems near the surface of the core are examined, and conclusions are drawn regarding the critical separation required to give rise to certain observed features of the surface pattern in polar regions. A.T.Price

551.16 : 550.38

9064. SECULAR VARIATION AND THE NON-DIPOLE FIELD. F.J.Lowes.
Ann. Géophys., Vol. 11, No. 1, 91-4 (1955).

The non-dipole and secular variation fields can each be well represented by the field of a few dipoles within the earth's core. For the secular variation these dipoles are radial and about 1000 km inside the core; for the non-dipole field their position and orientation is less certain. The secular variation is due mainly to the time-variation of the non-dipole field and may arise either from changes in the magnitude and direction of the representative dipoles, or from their movement. Since no appreciable correlation is found between the two fields, it appears that the latter mechanism is predominant. The westward drift of the non-dipole field accounts for an appreciable part of the secular variation; when its effect is subtracted the residual field still shows no correlation with the non-dipole field. It is concluded that the non-dipole field, as usually derived, is not the entire field produced by regional sources, which probably contribute about $\frac{1}{6}$th of the axial dipole field. A.T.Price

551.16 : 550.37

9065. ELECTRICAL CONDUCTIVITY OF THE EARTH'S CORE. T.Rikitake.
Ann. Géophys., Vol. 11, No. 1, 95-7 (1955).

Assuming that the secular variation is caused by varying electric currents flowing in the top layer of the earth's core, the field changes at the earth's surface will be reduced by currents induced in the mantle and in the deeper parts of the core. Calculation of these effects indicate that the conductivity of the core cannot exceed 10^{-4} e.m.u., and if it is greater than 10^{-5} e.m.u., the strength of a dipole at the core surface required to lead to a regional secular variation would exceed that of the dipole corresponding to the main field. A.T.Price

551.16 : 550.372

9066. THE ELECTRICAL CONDUCTIVITY OF OLIVINE AT HIGH TEMPERATURES AND PRESSURES. S.K.Runcorn and D.C.Tozer.
Ann. Geophys., Vol. 11, No. 1, 98-102 (1955).

The electrical conductivity of the earth's mantle can be inferred down to a depth of about 1000 km from studies of the transient geomagnetic variations, and below that from considerations relating to the main field and its secular variation. It remains small down to about 600 km depth and then rises rapidly to at least 10^{-2} ohm^{-1}.cm^{-1} at 900 km. The mean conductivity of the lower mantle is about 1 ohm^{-1}.cm^{-1}. The increase of conductivity with depth is probably due to increasing temperature, but the theory is complicated by the effects of high pressure. The ferromagnetic silicates which are likely to be the main constituents of the mantle exhibit intrinsic and impurity semiconductivities and ionic conductivities. At ordinary pressures the latter is predominant at temperatures above 1000° C, but theory suggests that it is suppressed by high pressure and that consequently the conductivity of the mantle is mainly due to intrinsic semiconductivity. In a homogeneous material this would require a temperature $> 10\,000^\circ$ C at the base of the mantle, which seems improbable. A change in chemical composition or structure, occurring possibly at a depth between 300 km and 1000 km, might account for the decrease of excitation energy required to make the results fit more recent estimates of the temperature. A.T.Price

551.16 : 550.384

9067. RELATIONS BETWEEN FLUCTUATIONS IN THE EARTH'S ROTATION, THE VARIATION OF LATITUDE AND GEOMAGNETISM. E.H.Vestine.
Ann. Géophys., Vol. 11, No. 1, 103 (1955).

The changes in the westward drift of the secular variation field appear to be anti-parallel to those deduced for the earth's rate of rotation from astronomical observations. This can be explained in terms of fluid motions of the core which carry the source of the magnetic field westward. Other associated motions afford an explanation of the variation of latitude. A.T.Price

551.16 : 525.35

9068. EVIDENCE FROM THE ROTATION OF THE EARTH. R.Revelle and W.Munk.
Ann. Géophys., Vol. 11, No. 1, 104-8 (1955).

The various mechanisms which might account for the changes in the rotation of the earth, as evidenced by changes in the length of day and the variation of latitude, are critically examined. The most probable cause of the fluctuations in the length of day having a period of a few decades is a transfer of angular momentum between core and mantle. These fluctuations appear to be correlated with the westward drift of the geomagnetic field. If it is assumed that the angular momentum transfer is due to electromagnetic coupling between core and mantle, theory indicates that the mean conductivity of the mantle must be of order 10^{-9} e.m.u. There is some weak evidence of a small variation of latitude in the same frequency band. This may be due to the same mechanism; on the other hand the observations could be explained by the change in moment of inertia due to the melting of the Greenland ice-cap. The smallness of the latitude variation indicates that the core motion must be largely zonal. A.T.Price

551.311.122

9069. DENSITY OF SINGLE CRYSTALS OF ICE FROM A TEMPERATE GLACIER. T.R.Butkovich.
J. Glaciol., Vol. 2, 553-9 (Oct., 1955).

Density of single crystals of ice from the Mendenhall

Glacier near Juneau, Alaska, a temperate glacier, was determined by the hydrostatic weighing method. It was found that the densities of single crystals are slightly but measurably variable from one crystal to another. The values range from a minimum of 0.91712 g/cm^3 to a maximum of 0.91728 g/cm^3, when corrected for −3.5°C, for the eight crystals measured. Any imperfections such as Tyndall figures (hexagonal prismatic voids) were immediately evident in the density determinations, and correction for these imperfections give a corrected density essentially the same as that of clear specimens. Two clear crystals aggregate specimens tested had a lower density than the pure single ice crystals. An error computation gives the value of the estimated maximum error of the density determinations as $\pm 2.1 \times 10^{-5}$ g/cm^3. A.

ATMOSPHERE. METEOROLOGY 551.5

551.501.7 : 551.510.535

9070. ACCURATE HEIGHT MEASUREMENTS USING AN IONOSPHERIC RECORDER. A.J.Lyon and A.J.G.Moorat.
J. atmos. terrest. Phys., Vol. 8, No. 6, 309-17 (June, 1956).

A method for the calibration of an ionospheric recorder is described, which corrects errors in height measurement arising from the distortion of the echo-pulse in its passage through the receiver. The amount of this error depends on the echo-amplitude, and is shown to vary in an approximately linear manner with the width of the recorded echo-trace. Several methods of checking the calibration confirm that it is reliable to within ± 2 km. Using a calibrated recorder and an expanded time-base, it is possible to measure E-region equivalent heights to this order of accuracy. The systematic error due to pulse distortion will, in general, cause the heights recorded in routine ionospheric measurements to be from 5 to 15 km too high. Some consequences of this, e.g., for MUF predictions, are mentioned. A.

551.510.41.08

9071. REMARKS ON CHEMICAL SAMPLING METHODS OF ATMOSPHERIC OZONE. I.Rasool and A.Vassy.
C.R. Acad. Sci. (Paris), Vol. 243, No. 3, 298-9 (July 16, 1956). In French.

Simultaneous measurements were made of the concentration of atmospheric ozone near the ground by chemical sampling and by photographic spectrophotometry. A comparison of the results shows that chemical sampling of itself is correct even at very slight concentrations but errors arise from slow replenishment from the surrounding air when the wind is too light. A minimum wind speed of 1.5 m/s is required for replenishment to obtain reliable results. R.S.Read

551.510.535 : 550.384

9072. GEOMAGNETIC DISTORTION OF THE F2 REGION ON THE MAGNETIC EQUATOR. M.Hirono and H.Maeda.
J. geophys. Res., Vol. 60, No. 3, 241-55 (Sept., 1955).

The direct relation between the geomagnetic Sq-variation and the vertical electron drift of the F2-region on the magnetic equator is examined. It is shown that the electric field in the F2-region accompanied by S_q electric current produces the vertical drift which is sufficient to interpret the main features of the anomaly of the F2-region on the equator. It is to be noticed that the main term of the drift velocity is diurnal. The daily variations of the maximum electron density and its height in the F2-region are calculated under consideration of the vertical electron drift for the reasonable distribution of decay coefficient with altitude inferred by observed results. The calculated F2 daily variations have a striking resemblance with those observed near the magnetic equator. When the ion production takes its maximum value at about 200 km, there appears a lower secondary maximum of electron density which agrees well with the observed F1-layer. The change of characteristics of daily variations of the F2-region with the sunspot-cycle is likely to be accounted for by a slight shift of the phase of the drift. A.

551.510.535

9073. ON THE EXISTENCE OF A "Q.L."–"Q.T." "TRANSITION-LEVEL" IN THE IONOSPHERE AND ITS EXPERIMENTAL EVIDENCE AND EFFECT. D.Lepechinsky.
J. atmos. terrest. Phys., Vol. 8, No. 6, 297-304 (June, 1956).

The magneto-ionic theory shows that when the effects of collisions and of the earth's magnetic field are taken into consideration, the propagation is "quasi-longitudinal" in the lower part of the ionosphere, where the collision frequency is high and "quasi-transverse" in its upper part, where the collision frequency is low. For vertical incidence, the altitude at which the transition between the Q.L. and Q.T. regions occurs is that corresponding to the critical collision frequency ν_c which is a function of the gyrofrequency and of the magnetic dip angle only. For France, where this angle is 64° to 65°, the transition level is located at about 95 km, i.e. within the E region. At midday, when the maximum electron density of the E layer occurs at the lowest heights, it may happen that this maximum penetrates the Q.L. region. The evaluation of N_{max} should therefore be made with caution, for in the latter case, the critical frequency observed (corresponding to the ordinary trace vertical tangent), when used in the classical formula, only valid in the Q.T. region, leads to a serious underestimate of N_{max}. When N_{max} is located somewhat lower than the transition level, or exactly at this altitude, the h'f record should show either a crochet (in the first case), or a hollow, i.e. a complete absence of trace (in the second case). Crochets and hollows of this sort are indeed quite often found in the h'f records of the Poitiers and Domont stations. It is shown how these hollows and crochets can be fully explained on the basis of the magneto-ionic theory and that they are in fact an excellent evidence of the existence in the E region of the Q.L.-Q.T.. transition level. Finally, attention is drawn to the criteria now in use to determine the f_0E, which often leads to an apparent flattening of the N_{max} diurnal curve, and appropriate formulae and methods are suggested to find the correct values of N_{max}. A.

551.510.535

9074. SPORADIC ECHOES FROM THE E REGION OVER AHMEDABAD (23° 02' N, 72° 38' E). K.M.Kotadia.
J. atmos. terrest. Phys., Vol. 8, No. 6, 331-7 (June, 1956).

A study is made of the sporadic E echoes observed in the ionospheric h'-f records of Ahmedabad ($\Phi = 13.6°$N). From the analysis of the data for 1953-1954, a sunspot minimum period, it was found that three types of sporadic, namely (i) Esc at 95-100 km, (ii) Esn at 105-125 km, and (iii) Ess at 115-125 km, occur in the E region. The overall behaviour of Es has been shown as being due to the combination of the characteristics of these three types. The sporadic ionization of type Esc has a maximum frequency of occurrence in the late evening hours, and has a thin structure. It is apparently evolved out of a downward drift of the residual ionization of the normal E layer. No correlation could be established with meteor activity. Esn shows a minimum in the afternoon and maximum in late-night hours before dawn. Ess is developed by the vertical downward movement of the E2 layer. A.

551.510.535

9075. THE EFFECTIVE RECOMBINATION COEFFICIENTS IN THE E AND F1 LAYERS DURING THE SOLAR ECLIPSE OF 25 FEBRUARY 1952. C.M.Minnis.
J. atmos. terrest. Phys., Vol. 9, No. 1, 36-44 (July, 1956).

Only part of the E-layer ionizing radiation on 25 February 1952 can be regarded as having its origin in a uniformly radiating disk, and it is necessary to postulate the existence of two isolated sources near the east and west limbs of the sun. The contribution of each source to the value of q_0/α' for the

unobscured disk can be derived from the response of the E-layer to the eclipse and expressed as a linear function of $1/\alpha'$. When the corresponding functions for Khartoum and Ibadan are equated and solved for α', it is found that at both places $\alpha'_E = 1.2 \times 10^{-8} cm^3 sec^{-1}$, as compared with $\alpha'_E = 1.5 \times 10^{-8} cm^3 sec^{-1}$ which was obtained earlier by assuming that, at second contact at Khartoum, the intensity of the ionizing radiation fell to zero. For the F1 layer it is concluded that $\alpha'_{F1} = 0.65 \times 10^{-8} cm^3 sec^{-1}$. A.

551.510.535 : 538.566.3

9076. ON THE PROPAGATION OF RADIO WAVES THROUGH THE UPPER IONOSPHERE. G.R.Ellis.
J. atmos. terrest. Phys., Vol. 9, No. 1, 51-5 (July, 1956).

The low-frequency limit for the propagation of radio waves through the ionosphere is discussed. It is shown that reflection and absorption of extraordinary waves can occur well above the F-region near the level where $f = f_H$, if the wave frequency is less than $f_H F_2$, and if the electron density near this level is not negligible. In these circumstances the low-frequency limit will be determined by f_0F_2, and observations of cosmic radio emission at frequencies much below 1 Mc/s are unlikely. A.

551.510.535

9077. ELECTRON RESONANCE IN IONOSPHERIC WAVES. C.O.Hines.
J. atmos. terrest. Phys, Vol. 9, No. 1, 56-70 (July, 1956).

Large-scale travelling disturbances, now frequently observed in the ionospheric F-layer, are interpreted in terms of an electron resonance. This phenomenon arises when an initial atmospheric disturbance sets the electrons into natural modes of oscillation, and the resultant increase of electron displacements then enhances the likelihood of detection by present (radio) techniques. Certain qualitative features of the observed disturbances can be explained on this basis, and a quantitative comparison provides estimates for several ionospheric parameters which are in good agreement with the values expected. Further application of an improved theoretical development may well provide an extremely useful method of investigating the physical properties of the ionosphere. A.

551.510.535

9078. THE EFFECT OF AMBIPOLAR DIFFUSION IN THE NIGHT-TIME F LAYER. J.W.Dungey.
J. atmos. terrest. Phys., Vol. 9, No. 2-3, 90-102 (Aug.-Sept., 1956).

Since the density of neutral particles in the F region is now thought to be smaller than previous estimates, ambipolar diffusion is expected to have an important influence on the behaviour of the F layer. Its theoretical investigation is greatly simplified by the assumption, that the rate of loss of electrons is proportional to the first power of the electron density, N, for which strong evidence has recently been found; this assumption makes the problem linear. Motion of the ionization, other than diffusion, may be approximated by a vertical velocity w, independent of height. With the unreal assumption that w is also constant in time, the general solution for N as a function of height and time can be expressed as a sum of functions which decay exponentially with time and which have arbitrary coefficients. The most slowly decaying of these provides a model which is discussed in this paper; it is very similar to a Chapman layer. Although the observed part of the layer can be closely fitted by a parabola, it is found that little fundamental information can be derived without obtaining true N—h curves, except that the parabolic width gives quite a good measure of the scale height. This is used to study the sunspot-cycle variation of F-region temperature, and correlations are found with both f_0F1 and the magnetic C figure. A.

551.510.535

9079. EQUATORIAL IONOSPHERIC ABSORPTION. N.J.Skinner and R.W.Wright.
J. atmos. terrest. Phys., Vol. 9, No. 2-3, 103-17 (Aug.-Sept., 1956).

A study has been made of the variation of absorption with frequency and sun's zenith distance χ at Ibadan at vertical incidence. Since the propagation at Ibadan is almost purely transverse, simple theories in terms of deviative and non-deviative absorption may be applied. It is found that the non-deviative absorption appears to obey a law of proportionality to the inverse frequency. The total absorption varies as $(\cos \chi)^n$, where n is about 0.7. These variations are accounted for by assuming that the nondeviative absorption takes place in a Chapman-type D layer at a level where the electron collisional frequency is of the same order as the angular frequency of the exploring radio signal. Some comparisons are made with the absorption results from other stations. In particular, it is found that the frequency and seasonal variations at Singapore are similar to those at Ibadan. A.

551.510.535

9080. RECOMBINATION AND ATTACHMENT IN THE F1 AND F2 LAYERS DURING THE SOLAR ECLIPSE OF 25 DECEMBER 1954. M.E.Szendrei and M.W.McElhinny.
J. atmos. terrest. Phys., Vol. 9, No. 2-3, 118-30 (Aug.-Sept., 1956).

The variations of electron density during the annular solar eclipse of 25 December 1954 for various fixed heights in the F1 and F2 layers of the ionosphere are compared with the variations expected under alternative assumptions that the removal of free electrons is by recombination and attachment. The recombination and attachment coefficients so deduced do not vary with height in the F1 layer, and it would appear that the recombination process is predominant in this region. In the F2 layer, the recombination and attachment coefficients decrease with height in a regular manner and are compared with values obtained by other workers. A.

551.510.535

9081. LUNAR VARIATIONS OF THE F2 LAYER AT IBADAN. R.A.Brown.
J. atmos. terrest. Phys., Vol. 9, No. 2-3, 144-54 (Aug.-Sept., 1956).

Regular readings of F2-layer parameters taken at Ibadan from December 1951 to April 1954 have been analysed for lunar and luni-solar variations. Harmonic analysis shows that the lunar variations of h_mF2, y_mF2, f_0F2 and $h'F2$ are semi-diurnal and of considerable amplitude. These variations are presented as harmonic dials. They show marked seasonal variation of amplitude and phase. The luni-solar effects are also large; the phase of the lunar oscillations changing by particularly large amounts during the course of a solar day. Values of the recombination coefficient at various heights in the F2 region are deduced from the luni-solar variations, and shown to be consistent with an exponential decrease with height. A.

551.510.535

9082. RESEARCHES ON THE GEOMAGNETIC DISTORTION IN THE IONOSPHERE.
I. OBSERVED FACTS OF THE GEOMAGNETIC DISTORTION IN THE IONOSPHERE. H.Maeda.
II. THEORETICAL STUDY ON THE GEOMAGNETIC DISTORTION IN THE F2 LAYER. K.I.Maeda.
III. CHARACTERISTICS OF THE F2 LAYER ON THE MAGNETIC EQUATOR. M.Hirono and H.Maeda.
IV. EFFECT OF GRAVITY AND IONIZATION PRESSURE GRADIENT ON THE VERTICAL DRIFT IN THE F2 REGION. M.Hirono.
Rep. Ionosphere Res. Japan, Vol. 9, No. 2, 59-70, 71-85, 86-94, 95-104 (1955).

Pt I. An extensive study is made of the latitude distribution and the daily variation of all ionospheric layers (F2, F1 and E) during the sunspot minimum period (1953-1954), to examine the fact of geomagnetic distortion in the ionosphere,

and the harmonic components of the geomagnetic Sq variations are presented, analysed from the data of the Second Polar Year.

II. The vertical and horizontal drifts of electrons in the F2 region are studied in connection with the geomagnetic variation and the effects of drifts on the F2 layer are treated. It is found that the geomagnetic distortion in the F2 layer can largely be interpreted by the drift.

III. The direct relation between the geomagnetic Sq-variation and the vertical electron drift of the F2 region on the magnetic equator is examined. It is shown that the electric field in the F2 region accompanied by Sq electric current produces the vertical drift which is sufficient to interpret the main features of the anomaly of the F2 region on the equator. It is to be noticed that the main term of the drift velocity is diurnal.

IV. The effect of gravity and ionization pressure gradient is examined in relation to the vertical drift by electrodynamic force in the F2 region. It is found that if the number density of the gas at 300 km level is not much less than $10^{10}/cm^3$/ the semi-diurnal variation of the h_mF2 can be interpreted by drift theory. A.

551.510.535

9083. STUDIES ON THE DISTURBANCES IN F2 LAYER ASSOCIATED WITH GEOMAGNETIC DISTURBANCES. K.Sinno.
Rep. Ionosphere Res. Japan, Vol. 9, No. 3, 166-73 (1955).

The main course of investigation on F2 disturbance, which has been studied by the author for the last three years, is summarized as follows: (1) The separation of variations in foF2 and h'F2 associated with geomagnetic storms into two parts depending on the universal time and local time, the so-called $D_{st}(F2)$ and $S_D(F2)$, respectively, was clarified. (2) The development process of the F2 disturbance was investigated in respect to each of $D_{st}(F2)$ and $S_D(F2)$. It is concluded that $S_D(foF2)$ exists in the earlier stage of a geomagnetic storm and $D_{st}(foF2)$ grows in the comparatively later stage. (3) The latitudinal and seasonal characteristics are shown. (4) Investigations were made in the behaviour of the F2-layer according to the different levels of geomagnetic activities. Results showed that the F2-layer disturbance was generally in proportion to the geomagnetic activities, except for $D_{st}(foF2)$ variation in winter. (5) As to the successive yearly variation of ionospheric disturbance, it was found that the phase of $S_D(F2)$ would lag behind according to the decrease of sunspot activity. A.

551.510.535

9084. A DISCUSSION ON THE VARIATION OF F-REGION HEIGHT. B.Chatterjee.
J. geophys. Res., Vol. 60, No. 3, 325-7 (Sept., 1955).

Variations of F2-region height with season and solar activity have been previously explained in terms of the author's picture of ionization distribution in the F-region. Different types of behaviours of F2-region height at different latitudes are accounted for with the presently accepted model of temperature distribution in the upper atmosphere. A.

551.510.535

RADIO-WAVE PROPAGATION IN THE IONOSPHERE. See also under "Electromagnetic waves and oscillations". Decimal classification 538.566.3

551.510.535 : 523.745

A NEW INDEX OF SOLAR ACTIVITY BASED ON IONOSPHERIC MEASUREMENTS. See Abstr. 7944

551.510.535 : 538.566.3 : 535.42

SOME ASPECTS OF DIFFRACTION THEORY AND THEIR APPLICATION TO THE IONOSPHERE. See Abstr. 8710

551.521.3

9085. SODIUM LINE IN THE ABSORPTION SPECTRUM OF AIR ABOVE THE SEA LEVEL. V.V.Shuleĭkin and P.F.Shakurov.
Dokl. Akad. Nauk SSSR, Vol. 106, No. 6, 991-3 (1956). In Russian.

Special technique was used to photograph the continuous spectrum of a light which travelled ca.10 km at an altitude of ca.50 m above sea level. Owing to the large width of the slit, the D doublet was not resolved. It was found that the curve of the absorption spectrum had a faint minimum coinciding with the D emission maximum. Formulae were developed to determine the number of excited Na atoms in sea air from the absorption curve; this number was determined to be 40-85/cm^3. F.Lachman

551.521.3 : 551.594.5

9086. ACHIEVEMENTS AND PROSPECTS IN AURORAL AND AIRGLOW RESEARCH. S.Chapman.
Airglow and the aurorae (Belfast) 1-8. See Abstr. 7088 (1956).

551.521.3

9087. EXAMINATION OF METHODS FOR THE DETERMINATION OF THE ALTITUDE OF THE LAYERS EMITTING THE NOCTURNAL LUMINESCENCE. D.Barbier.
Airglow and the aurorae (Belfast) 9-19. See Abstr. 7088 (1956). In French.

Following the suggestions of Bates and Dalgarno (1953) which favour lower altitudes for the nightglow than those obtained experimentally, van Rhijn's method of reducing the results of zenith-horizon observations is critically discussed, and it is shown to give results free from serious error if these are averaged from a long series of observations. Height estimates from a single night's observing may be quite inaccurate. D.R.Barber

551.521.3

9088. PHOTOELECTRIC STUDY OF THE NIGHT-AIRGLOW. M.Huruhata, H.Tanabe and T.Nakamura.
Airglow and the aurorae (Belfast) 20-6. See Abstr. 7088 (1956).

Simultaneous observations of the 5577 A nightglow with two identical photometers, 1110 km apart, gave by triangulation a height of 270-300 km for the emitting layer. Occasional correlation of F2-layer electron density with emission intensity was noted. D.R.Barber

551.521.3

9089. THE HEIGHT OF THE LAYER EMITTING [OI]-5577 IN THE NIGHT-AIRGLOW. H.Elsässer and H.Siedentopf.
Airglow and the aurorae (Belfast) 27-8. See Abstr. 7088 (1956).

Observations of the 5577 A nightglow with an automatic photometer at 3600 m altitude gave mean emission heights of 72 ± 10 km for the N. half, and 112 ± 13 km for the S. half of the sky, in line with the value predicted by Bates and Dalgarno (1953). D.R.Barber

551.521.3

9090. OBSERVATIONS OF THE [OI] - 5577 NIGHTGLOW AT SACRAMENTO PEAK, NEW MEXICO, FEBRUARY THROUGH JUNE, 1955. E.R.Manring and H.B.Pettit.
Airglow and the aurorae (Belfast) 29-37. See Abstr. 7088 (1956).

These observations, at latitude 32° 47 N, longitude 105° 48 W, and elevation 9250 feet, were made with a rapid surveying photometer, having a very high spectral purity. The intensity distribution is found to be much more uniform in position over the sky than previously reported. The observed intensity for any one night can, with considerable accuracy, be represented by the relation: $B(p, t) = B(p) \times B(t)$, where $B(p, t)$ is the brightness observed at position p, time t; $B(p)$ is a function of position only; and $B(t)$ of time only. The positional dependence, $B(p)$, was observed to change slowly and regularly throughout the period from February to June 1955. Deviations from this mathematical relation are essentially random in time and position. They are about 15 to 20% of the background. Careful measurements of Van Rhijn ratios have been made. These are found to vary considerably from night to night and with season, so that definite conclusions concerning heights are impossible at this time. A.

551.521.3

9091. PRELIMINARY RESULTS OF 8-COLOUR PHOTOMETRY OF THE LIGHT OF THE NIGHT SKY. D.Barbier.
Airglow and the aurorae (Belfast) 38-59. See Abstr. 7088 (1956). In French.

Measurements of the principal nightglow lines in eight selected spectral regions are corrected for extra-terrestrial light, and expressed in megaquanta. Correlations are found between (a), OI 5577 line, and Herzberg bands: and (b), Na-D doublet, and i.r. OH bands. The OI red lines appear unrelated to the above emissions. There is some evidence for the presence of a continuum of atmospheric origin, again uncorrelated with the emissions, which should exhibit an important pre-crepuscular effect. D.R.Barber

551.521.3

9092. INTENSITY VARIATIONS OF LINES, 6300, 5890 AND 5577 A, AND THE RED OH BANDS THROUGH SEVERAL NIGHTS: AND THE RATIO OF INTENSITIES OF THE 6300 AND 5577 LINES OF OI. P.Berthier and B.Morignat.
Airglow and the aurorae (Belfast) 60-2. See Abstr. 7088 (1956). In French.

Curves are given showing diurnal fluctuation of the line emissions, and of the OH bands at 6240 A. The OI intensity-ratio, 6300/5577, decreases at the beginning of the night due to the disappearance of twilight enhancement of the 6300 line. Later the ratio becomes approx. constant at ~ 0.2.
D.R.Barber

551.521.3

9093. A NOTE ON THE DIURNAL VARIATION OF THE OH EMISSION IN THE NIGHTGLOW. E.B.Armstrong.
Airglow and the aurorae (Belfast) 63-6. See Abstr. 7088 (1956).

551.521.3

9094. THE DETERMINATION OF THE WIDTHS OF THE AIRGLOW AND TWILIGHT FLASH. J.G.Phillips.
Airglow and the aurorae (Belfast) 67-72. See Abstr. 7088 (1956).

Observations made with a Fabry–Perot interferometer with multilayer dielectric coatings on the plates have given values for the Doppler widths of the [O I] λ 5577 and [O I] 6300 lines in the airglow and twilight flash respectively. The observed profile of the λ 5577 line indicates a temperature of between 155°K and 231°K for the emitting region. The profile of the λ 6300 line, observed in the twilight in Alaska, indicates a temperature of $750^\circ K \pm 200^\circ K$. A.

551.521.3

9095. INTERFERENTIAL STUDY OF THE RED LINES OF THE NIGHT SKY. J.Cabannes and J.Dufay.
Airglow and the aurorae (Belfast) 73-85. See Abstr. 7088 (1956). In French.

For abstract, see Abstr. 4753 (1956).

551.521.3

9096. ON THE DETECTION OF THE INFRA-RED NIGHT-AIRGLOW. V.I.Krassovsky.
Airglow and the aurorae (Belfast) 86-90. See Abstr. 7088 (1956).

Work on the i.r. night-airglow emission carried out in the U.S.S.R. during the past ten years is briefly summarized. Recent observations in the i.r. region up to 11 000 A with an improved spectrograph have shown that at times when the hydroxyl emission is weak enough to allow long exposures, some diffuse emission and unidentified bands, tentatively ascribed to scattered starlight and sunlight, are apparent at wavelengths greater than 7000 A. An unexplained intensity minimum has been observed near 9800 A. Two lines in the region of the P branch of the (3-0) hydroxyl band which have not been identified finally as yet. A.

551.521.3 : 551.593.55

9097. EMISSION FROM A SODIUM CLOUD ARTIFICIALLY PRODUCED BY MEANS OF A ROCKET. H.D.Edwards, J.F.Bedinger, E.R.Manring and C.D.Cooper.
Airglow and the aurorae (Belfast) 122-34. See Abstr. 7088 (1956).

Following Bates' suggestion, three kilograms of metallic sodium vapour were ejected into the atmosphere from 50 to 113 km by means of two Aerobee rockets. The rockets were launched at the beginning of evening twilight on 21 January and 12 October 1955. Enhanced sodium emission at 5890 A was definitely observed visually, photometrically and spectrographically from 85 km to 113 km during twilight. No sharp time discontinuities in intensity were observed when the region was enclosed by the earth's optical shadow. No increase in emission was observed during the night. Possible explanations are given for the lack of emission below 85 km. Spreading of the sodium cloud indicated winds at the 85 km level to be 180 m.p.h. from the north-west and 100 m.p.h. from the south-east at the 110 km level. A.

551.521.3

9098. AN ATTEMPT TO MEASURE SOME AIRGLOW EMISSIONS DURING A SOLAR ECLIPSE. M.J.Koomen, C.Lock, D.M.Packer, R.Scolnik and R.Tousey.
Airglow and the aurorae (Belfast) 135-41. See Abstr. 7088 (1956).

551.521.3 : 551.594.5 : 535.33

9099. SPECTRA OF THE AURORA AND NIGHT-AIRGLOW IN THE INFRA-RED REGION UP TO 11 800 A.
B.A.Bagariazky and N.I.Fedorova.
Airglow and the aurorae (Belfast) 174-77. See Abstr. 7088 (1956).

Spectra of aurorae obtained with an i.r. image converter in conjunction with a grating spectrograph show that at wavelengths greater than 9000 A the Meinel N_2^+ system is the only feature revealed by short exposures. It is tentatively suggested that the vibrational numbering given to the N_2^+ bands by Meinel and Douglas may require revision, as there is no indication of a zero band at about 11 100 A on the spectrograms obtained up to the present. An anomalous increase increase in intensity in the P branch of the (4, 1) OH band in the night airglow during intense auroral displays is thought to be due to some additional emission, possibly the ($^2D - {}^2P$) lines of [N I] at 10 398 A and 10 407 A. A.

551.521.3

9100. INFRA-RED NIGHT AIRGLOW AS A MANIFESTATION OF THE PROCESS OF OXYGEN RECOMBINATION. V.I.Krassovsky.
Airglow and the aurorae (Belfast) 193-6. See Abstr. 7088 (1956).

The OH infrared night airglow may arise from the reactions, $O_2'(V \leq 27) + H \rightarrow OH' + O : OH' \rightarrow OH + h\nu$, involving dissociation and recombination of atmospheric O. At the 100 km level, the high concentration of O atoms will suffice to provide a constant supply of excited O_2 molecules through the night: and so will maintain a quasi-constant level of OH emission.
D.R.Barber

551.521.3

9101. OZONE–HYDROGEN HYPOTHESIS OF THE HYDROXYL NIGHT-AIRGLOW. V.I.Krassovsky.
Airglow and the aurorae (Belfast) 197-200. See Abstr. 7088 (1956).

According to Bates and Nicolet (1950), the OH emission is initiated by an ozone–hydrogen reaction, $O_3 + H \rightarrow OH' + O_2 : OH' \rightarrow OH + h\nu$, giving max. excitation for the 9th vibrational level of the ground state. Reasons are advanced for believing that the limiting OH excitation is not caused by the O_3-H reaction: but may be explained by decay of OH previously excited to vibrational levels ≥ 10, following the reactions,

$OH' + O_2 \rightarrow O_3' + H$: $OH' + N_2 \rightarrow N_2O' + H$. Below 100 km, and in the presence of O_2 and N_2 molecules, the above reactions will produce a practically complete decay of all excited OH' molecules for which $v \geq 10$. D.R.Barber

551.521.3

9102. ON THE DAY AIRGLOW. V.M.Morozov and I.S.Shklovsky.
Airglow and the aurorae (Belfast) 201-3. See Abstr. 7088 (1956).

The results of photometric measures of sky-brightness made in Brazil during the total solar eclipse of 20 May, 1947 (Richardson and Hulbert, 1949) are found to contradict recent rocket determinations of the brightness of the day airglow at a supposed height of 135 km. The solar eclipse data demonstrate the absence of atmospheric emissions giving sky-brightness values of up to 0.011 of the ground value at 5590 A at heights above 90-120 km. The readings obtained from the rocket-borne photometer may be due to an instrumental effect. D.R.Barber

551.521.3 : 535.333

9103. A LABORATORY SOURCE OF THE HERZBERG BANDS OF O_2. A.G.Gaydon.
Airglow and the aurorae (Belfast) 262-3. See Abstr. 7088 (1956).

The spectrum of the afterglow of pure oxygen, produced in a relatively simple discharge, consists of the Herzberg system of O_2, lying mainly in the region 2600-4300 A. A new progression has been found, which necessitates a slight revision of Herzberg's original vibrational analysis. Other features in the spectrum include the 5577 A green auroral line and the atmospheric band of O_2 at 7593 A. A new inter-combination system has been discovered, whose bands have the same initial state as those of the Herzberg system, so that it should be present in the nightglow. A.

551.521.3 : 535.333

9104. THE REACTION OF ATOMIC HYDROGEN WITH OZONE. J.D.McKinley, Jr, D.Garvin and M.J.Boudart.
Airglow and the aurorae (Belfast) 264-9. See Abstr. 7088 (1956).

Near i.r. emission spectrograms of vibrationally excited hydroxyl radicals in the ground state have been obtained upon mixing H atoms and ozone. A recent interpretation of a particular source of the night-sky radiation has been verified. A non-equilibrium distribution of energy between the reaction products is indicated. The subsequent reactions between hydroxyl, oxygen, and atomic and molecular hydrogen have been studied. A.

551.521.3 : 535.379

9105. ON THE CHEMILUMINESCENCE OF THE SODIUM D LINES IN THE REACTION BETWEEN OZONE AND SODIUM VAPOUR. Y.Tanaka and M.Ogawa.
Airglow and the aurorae (Belfast) 270-2. See Abstr. 7088 (1956).

Ozone is found to react with sodium vapour to produce strong luminescence of the D-lines, a result not obtained with atomic oxygen as the reactor. Molecular sodium appears to be responsible for the chemiluminescence; and the intensity of the latter is found to decrease with an increase of temperature in the range, 250-450° C, becoming very weak at 450° C.
D.R.Barber

551.521.3 : 535.371

9106. LABORATORY EXPERIMENTS ON THE DAY AIRGLOW. J.F.James.
Airglow and the aurorae (Belfast) 273-5. See Abstr. 7088 (1956).

When an intense beam of ultraviolet light is passed through O_2 and N_2 at a pressure of about 0.05 mm Hg, the path is made luminous by fluorescence, the exciting radiation being less than 1200 A. The fluorescent light is restricted to visual wavelengths below 5000 A: and the experiments indicate the almost certain presence of a blue fluorescence of the upper atmosphere in daytime whose intensity is probably too weak to explain the rocket airglow observations of Miley et al (1953).
D.R.Barber

551.521.3 : 551.593.55 : 535.33.07

9107. A METHOD FOR THE CONTINUOUS SPECTROGRAPHIC MEASUREMENT OF INTENSITY OF THE BRIGHT LINES OF THE NIGHT SKY. J.Dufay, P.Berthier, M.Dufay and B.Morignat.
Airglow and the aurorae (Belfast) 351-4. See Abstr. 7088 (1956). In French.

Apparatus is described for continuously recording twilight- and night-airglow spectra on photographic material, using an adaptation of the Cojan 2-prism F/0.65 spectrograph (Abstr. 158/1949). To achieve this, the plate is moved at a uniform rate past the exit-slit in a direction parallel to the spectrum lines. Auxiliary spectrographic units provide photographic calibration and time-scales; and four synchronous motors give a choice of recording speeds with a range of effective exposures from 1 to 100 minutes. Sample records of the principal airglow emissions at 5577, 5892, and 6300-63 A are reproduced. D.R.Barber

551.521.3 : 551.593.55 : 535.247.4

9108. THE USE OF BIREFRINGENT FILTERS IN MEASUREMENTS OF THE AIRGLOW. M.J.Koomen, D.M.Packer and R.Tousey.
Airglow and the aurorae (Belfast) 355-65. See Abstr. 7088 (1956).

A photometer is described that measures directly the intensity of a single emission line such as the 5577 A emission of oxygen in the night or twilight airglow. No correction for the background continuum is required. The components of the filter are, an interference filter, a polarizer, a thick birefringent plate, a quarter-wave plate, an analyser in continuous rotation, and a lens imaging the sky on a photomultiplier. The band pass of the filter is a continuously sliding channelled spectrum of 3.5 A separation. Thus the line, but not the continuum, isolated by the interference filter, was modulated and amplified by a.c. methods. The use and capabilities of the instrument are discussed and some data on the night and twilight airglow are presented. A.

551.521.3 : 551.594.5 : 535.417

9109. THE OBSERVATION OF LINE PROFILES IN THE AIRGLOW AND AURORA WITH A PHOTOELECTRIC FABRY–PEROT INTERFEROMETER. E.B.Armstrong.
Airglow and the aurorae (Belfast) 366-73. See Abstr. 7088 (1956).

The auroral OI line at 5577 A has been observed with a p.e. Fabry–Perot interferometer, order of interference 11 400, the apparatus being based on that developed by Jacquinot and Dufour (1949). Observations of the fringe-profiles from a quiet auroral arc gave an estimated upper-atmospheric temperature of 370° K. D.R.Barber

551.521.3 : 551.594.5 : 535.417

9110. USE OF A RECORDING FABRY–PEROT INTERFEROMETER FOR THE MEASUREMENT OF λ5577 A EMISSION TEMPERATURES IN AIRGLOW AND AURORAE. R.V.Karandikar.
Airglow and the aurorae (Belfast) 374-87. See Abstr. 7088 (1956).

Previous interferometric work on the green line at 5577 A of nightglow, and aurorae is reviewed. The application of the Jacquinot–Dufour method to the electronic recording of F-P. intensity patterns is discussed; and its limitations pointed out. In nightglow work, usual methods of continuous recording are severely restricted by the very small photocurrents involved (photo-multiplier output, $\sim 7.5 \times 10^{-10}$ amp): this restriction is largely eliminated in auroral work.
D.R.Barber

551.521.3 : 551.594.5 : 535.247.4

9111. A NEW TYPE OF NIGHTGLOW-AURORAL PHOTOMETER. P.St.Amand.
Airglow and the aurorae (Belfast) 395-8. See Abstr. 7088 (1956).

The principle of a new type of photoelectric photometer capable of dealing with a long range of light-intensities, and in which a response proportional to the log. intensity is achieved, is outlined. Continuous matching of sky and calibration fields is obtained by means of a motor-driven photometric wedge. The calibration source is a self-luminous compound excited by a radioactive material. Since a field-matching method is involved, the calibration does not depend upon the sensitivity of any electronic component, but only on the stability of the optical wedge and luminescent light source.

D.R.Barber

551.521.3 : 551.501.7

9112. AN EXPERIMENTAL METHOD FOR MEASURING THE HEIGHTS OF LUMINESCENT LAYERS IN THE ATMOSPHERE FROM A ROCKET BY UTILIZING A BIAXIAL POINTING CONTROL. F.E.Nicodemus, H.D.Edwards and S.N.Ghosh.
Airglow and the aurorae (Belfast) 399-410. See Abstr. 7088 (1956).

The van Rhijn method, used to measure the heights of emitting layers in the airglow with ground-based apparatus, suffers from uncertainties due to absorption and scattering of light by the gases in the dense lower atmosphere. These uncertainties can be avoided if measurements are carried out by a rocket-borne photometer or radiometer above the scattering layer (40 km). In the method described here, such measurements can be made by a photometer which is stabilized by means of the photoelectrically controlled arm (instrument case) of the biaxial pointing control. The height of the layer is measured by the variation, with rocket altitude, of the observed airglow intensity in a horizontal direction, even if the layer is far above the peak of the rocket trajectory. The rotating-plane mirror produces a slow conical scan (which has been adjusted to include the horizontal) at a fixed angle about the sun (moon). From the telemetered record of intensities, the horizontal signals are selected and then plotted to show their variation with rocket altitude. The height of the emitting layer is determined by the best match between the experimental curve and the theoretical curves for different heights. It is proposed that this method be used to measure the heights of oxygen 6300 A and/or sodium 5894 A lines in the day airglow and, if the pointing control can be modified for guidance by the moon, the height of Meinel OH bands (near infrared) and/or oxygen 5577 A could then be studied at night. A.

551.521.3 : 551.594.5

9113. THE AIRGLOW AND THE AURORAE. Edited by E.B.Armstrong and A.Dalgarno.
London and New York: Pergamon Press (1956) viii + 420 pp. (Supplement to the Journal of Atmospheric and Terrestrial Physics).

For abstracts see Abstr. 7088, 8556, 8651-2, 8654-5, 8701, 8830, 8832, 9086-112, 9120, 9122-6, 9133-45 (1956).

551.521.3 : 551.594.5 : 535.333

MOLECULAR BAND INTENSITIES AND THEIR INTERPRETATION. See Abstr.8655

551.521.326 : 551.594.5 : 535.241

9114. A PHOTOMETRIC UNIT FOR THE AIRGLOW AND AURORA. D.M.Hunten, F.E.Roach and J.W.Chamberlain.
J. atmos. terrest. Phys., Vol. 8, No. 6, 345-6 (June, 1956).

It is suggested that the angular surface brightness B of these sources be measured in units of 10^6 quanta/cm^2 sec sterad. The number quoted should be $4\pi B$, and the unit of $4\pi B$ should be called the rayleigh. The advantages of this convention are pointed out and typical values of $4\pi B$ for the night and twilight airglow and the aurora are given. A.

551.576.1

9115. A NEW ASPECT OF COALESCENCE THEORY. J.W.Telford.
J. Meteorol., Vol. 12, No. 5, 436-44 (Oct., 1956).

The process of growth by coalescence is examined from the viewpoint of a discrete rather than a continuous accretion process. It is concluded that, for drops beginning growth at twice the volume of their neighbours, random fluctuations in the times taken for different drops to effect captures can lead to the formation of a complete raindrop spectrum in times shorter than that required for growth to raindrop size by the continuous growth process. Under typical conditions, drops of 23-microns radius can form in the order of 5 minutes in a cloud of droplets of 10 microns, while smaller numbers of much larger drops can be expected in reasonable times. The latter are likely to be important in chain-reaction theories.

A.

551.576.1 : 551.594

9116. RAINDROP ELECTRIFICATION BY THE ASSOCIATION OF RANDOMLY CHARGED CLOUD DROPLETS. R.Gunn.
J. Meteorol., Vol. 12, No. 6, 562-8 (Dec., 1955).

Light ions generated in the atmosphere by cosmic rays and radioactivity normally diffuse on to cloud droplets and establish a nearly symmetrical Gaussian distribution of positively and negatively charged droplets. When the cloud becomes unstable, these cloud elements grow by association and the charges accumulate to establish a new equilibrium consisting of nearly equal numbers of larger and highly charged positive and negative cloud droplets. Growing raindrops or graupel falling through such a cloud are accordingly bombarded by both positive and negative droplets, and this establishes a statistical accumulated charge on the various drops. The distribution of the number of drops in relation to the sign and magnitude of the free charge is worked out from basic principles and shown to agree remarkably well with the magnitude and distribution of drop charges measured inside precipitating clouds. The mean drop charge, irrespective of sign, depends on the square root of the drop size and kinetic energy of the small droplets relative to the larger moving drops. An equipartition is established between the electrical potential energy carried by the larger drops and the relative kinetic energy of the smaller drops. The estimated drop charges on warm rain or graupel are sufficiently large to account for thunderstorm phenomena, provided only that some unspecified process systematically separates the positively and negatively charged drops. The charges produced at the rain forming level commonly approximate 50 electrostatic units per gram. The observed electrification of quietly falling rain is primarily a manifestation of the ionization produced in the atmosphere by radioactivity and cosmic rays. A.

551.577.59 : 523.5

9117. THE RELATION BETWEEN RAINFALL AND METEOR SHOWERS. E.G.Bowen.
J. Meteorol., Vol. 13, No. 2, 142-51 (April, 1956).

Examination of rainfall figures for a large number of stations shows that there is a tendency for more rain to fall on certain calendar dates than on others. There is a close correspondence between the dates of the rainfall maxima in both the northern and southern hemispheres, and this is difficult to explain on a climatological basis. The effect might, however, be due to an extraterrestrial influence. The rainfall peaks occur approximately 30 days after prominent meteor showers, and it is suggested that they are due to the nucleating effect of meteoritic dust falling into cloud systems in the lower atmosphere, the time difference being accounted for by the rate of fall of the material through the atmosphere. The hypothesis is tested for a particular meteor stream, the Bielids, which is known to have a 6.5-year period. The rainfall 30 days after the meteor shower is found to have a similar period. Furthermore, the phase of the rainfall periodicity is almost identical with that

of the meteor shower. The data examined are confined to the month of January, and it is proposed to extend the investigation to other months in future papers. A.

551.577.59 : 523.5

9118. ON METEORS AND RAINFALL. F.L.Whipple.and G.S.Hawkins.
J. Meteorol., Vol. 13, No. 3, 236-40 (June, 1956).

The correlations of heavy rainfall and of noctilucent clouds with meteor streams are examined with regard to the known facts of meteor astronomy. Photographic and radar observations show that the general influx of sporadic meteors is not greatly enhanced by the occurrence of a meteor stream, and it is unlikely that meteors within the present limits of observation could produce a change in the number of freezing nuclei sufficient to cause heavy rainfall. Comprehensive measurements of daylight meteor streams are cited which show no detailed correlation with the observations of noctilucent clouds — the meteoric debris suspended in the upper atmosphere. This again indicates that the debris contributed by observed meteor streams is insignificant. The role of micrometeorites that enter the atmosphere without producing detectable light or ionization is considered. It is possible that a profusion of micrometeorites in a stream could affect the rainfall. But in space these particles must be removed from the stream before they are dispersed into sporadic orbits; otherwise the streams would not be so conspicuous against the sporadic background. A mechanism for removal is suggested which depends on the gradual disintegration of micrometeorites under the influence of corpuscular radiation from the sun. A.

551.578.4

9119. ON ICE-CRYSTAL NUCLEI AND OTHER SUBSTANCES FOUND IN SNOW CRYSTALS. K.Isono.
J. Meteorol., Vol. 12, No. 5, 456-62 (Oct., 1955).

Ice-crystal nuclei and other substances found in snow crystals collected in Japan were observed with an electron microscope and identified by means of their electron diffraction-patterns. Among the nuclei observed, clay particles were predominant. Besides these nuclei, minute particles were often found in snow crystals. They were identified as particles of sodium chloride and clays. A.

551.593 : 523.53

9120. NOTE ON PERSISTENT METEOR TRAILS. S.Chapman.
Airglow and the aurorae (Belfast) 204-5. See Abstr. 7088 (1956).

It is unlikely that the source of the energy emitted from long-enduring meteor trails derives from the meteor itself, and, in order to explain why some trails are persistent, the presence of a catalyst capable of converting some of the latent atmospheric energy into light, e.g. sodium, is suggested. A probable source of this energy is that produced by daytime dissociation of oxygen by solar u.v. radiation. D.R.Barber

551.593

9121. USE OF SPHERICAL HARMONICS IN ATMOSPHERIC OPTICS. S.Ya.Kogan.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 6, 1053-5 (1956). In Russian.

Presents a new method of solution of the Boltzmann equation of radiant energy transfer. The method, which has wide applications in physics and atmospheric optics, shows how the ambiguities of previous solutions can be resolved by a rigorous treatment of the boundary conditions. J.W.Gardner

551.593.55

9122. THE RATIO OF THE INTENSITIES OF THE COMPONENTS OF THE SODIUM DOUBLET IN THE TWILIGHT SPECTRUM. G.I.Galperin.
Airglow and the aurorae (Belfast) 91-4. See Abstr. 7088 (1956).

The mean value of the twilight intensity ratio, D2/D1 (obtained from 5 spectrograms with dispersion 84 A/mm at 5900 A) viz. 1.30 ± 0.04, agrees satisfactorily with a theoretical value deduced by means of the equation of transfer, neglecting polarization and assuming the number of free Na atoms to be the same in twilight as in daytime. The results support the hypothesis of resonant fluorescence, and suggest a negligible absorption of the D2 emission by water-vapour. D.R.Barber

551.593.55

9123. THE INTENSITY RATIO OF THE D LINES IN TWILIGHT. A.W.Harrison and A.V.Jones.
Airglow and the aurorae (Belfast) 95-8. See Abstr. 7088 (1956).

Twelve spectrograms at a dispersion of 70 A/mm obtained during the months of March-August in 1954, 1955, gave a mean value for the ratio, I_{D2}/I_{D1}, of 1.50 ± 0.02. Over this limited period, the results suggest a seasonal increase of the intensity ratio from March to July. D.R.Barber

551.593.55

9124. OBSERVATIONS OF ATMOSPHERIC EMISSION OF THE SODIUM D-LINES BY MEANS OF AN APPARATUS EMPLOYING MAGNETIC LINE SCANNING. J.E.Blamont.
Airglow and the aurorae (Belfast) 99-113. See Abstr. 7088 (1956). In French.

An absorption apparatus, utilizing the anomalous Zeeman effect in sodium vapour, has been used to study the intensity of twilight D emission as a function of solar zenith distance. Comparison of the results obtained from (i), a ground station at 650 m, and (ii), an airborne determination at 7000 m has proved indecisive as to whether the disappearance of emission during daytime is real, or only apparent : and further observations at a higher altitude will be necessary to decide this issue by providing in more detail evidence of the actual role played by solar u.v. radiation (see also Abstr. 2960/1954). D.R.Barber

551.593.55

9125. SEASONAL VARIATIONS OF TWILIGHT SODIUM EMISSION. D.M.Hunten.
Airglow and the aurorae (Belfast) 114-21. See Abstr. 7088 (1956).

Measurements of maximum intensity and height of maximum density over a two-year period are reported. The angular surface brightness varies between 5 and 44 x 10^7 quanta/cm^2. sec.sterad; the average variation is between 6.5 and 34, with minimum at the end of June and maximum at the end of February. The number of atoms/cm^2 column may be found by multiplying these by 10. The height varies not more than 1 or 2 km about the mean value 84.5 ± 5 km. The only mechanism for the intensity variation not eliminated by other evidence is the change in atom-ion equilibrium with the length of the day. This must be coupled with considerable transport of neutral sodium from the polar regions in winter to explain the large amplitude of variation, but still encounters the difficulty that high intensities are observed for some time after the end of the polar night. A.

551.593.55

9126. THE INTERPRETATION OF TWILIGHT MEASUREMENTS OF SODIUM EMISSION. D.M.Hunten.
Airglow and the aurorae (Belfast) 183-92. See Abstr. 7088 (1956).

The method previously used by the author for analysing twilight measurements is further discussed. When approximate corrections for extinction of the scattered light are included, a small modification is needed, giving an effective screening height of about 10 km. This is entirely consistent with resonance excitation. Only by ignoring the brightening of the light towards the horizon can a screening height of 47 km be found. Self-absorption effects are discussed by assuming single scattering only. The results disagree with observation, and it is suggested that correct results should resemble those found by ignoring self-absorption altogether. A.

551.593.55

9127. RESONANCE SCATTERING BY ATMOSPHERIC SODIUM. I. THEORY OF THE INTENSITY PLATEAU IN THE TWILIGHT AIRGLOW. J.W.Chamberlain.
J. atmos. terrest. Phys., Vol. 9, No. 2-3, 73-89 (Aug.-Sept., 1956).

Chandrasekhar's theory of radiative transfer is applied to the twilight airglow. The theory, which is most applicable to the region of the intensity plateau, is developed for comparison with measurements of the absolute brightness, the variation of brightness during twilight, and the intensity ratio D_2/D_1, to obtain the number of Na atoms per cm^2 (column). Numerical results are presented for a layer scattering solar D-line radiation and observed in the zenith or at zenith distance 75°. The effect of diffuse reflection of the D lines by the ground is also evaluated approximately. Some of Hunten's observations during winter give absolute brigthnesses that are slightly greater than the maximum values predicted by the theory. Means of reconciling this discrepancy are discussed. It is tentatively concluded on the basis of theory–observation comparisons that the abundance of Na varies between 10^9 (summer) and nearly 10^{10} (winter) atoms/cm^2 (column). It is suggested that the D_2/D_1 ratio may be the most reliable means of determining winter-time values of the abundance. A.

551.593.9

9128. SYNTHETIC ATMOSPHERIC CHEMILUMINESCENCE CAUSED BY THE RELEASE OF NO AT 106 km. J.Pressman, L.M.Aschenbrand, F.F.Marmo, A.Jursa and M.Zelikoff.
J. chem. Phys., Vol. 25, No. 1, 187 (July, 1956).

18.5 lb of NO was released from a rocket during the night and a glow of –2 visual magnitudes obtained, growing to the size of 4 moons. Preliminary examination of spectrograph records show that the radiation was continuous. It is believed that the NO acts as a catalyst for the recombination of atomic oxygen and that the energy involved is largely emitted as light. J.M.Hough

551.594

9129. ATMOSPHERIC-ELECTRIC ELEMENTS MEASURED AT UPPSALA DURING THE SOLAR ECLIPSE OF JUNE 30, 1954. H.Norinder and R.Siksna.
Ark. Geofys., Vol. 2, Paper 19, 417-21 (1955).

The following elements were measured during the eclipse (1) atmospheric-electric potential gradient, (2) air-earth current, (3) concentration of atmospheric small ions of both polarities measured with an ion counter equipped with the Weger condenser and adjusted at two limiting mobilities, (4) concentration of condensation nuclei with a photoelectric counter. A thermograph and hygrograph were in a well-ventilated hut. Comparison measurements were made before and after the eclipse. The weather conditions during the eclipse are described but because of their unfavourable nature no direct influence of the eclipse on the measured quantities could be established although some influence is evident. It is suggested that the state of aggregation of the particles forming the clouds (water drops, ice crystals) their structure, weight and thickness may cause a variation of the atmospheric-electric elements. R.S.Read

551.594.12

9130. FORMATION OF AN ARTIFICIAL ION CLOUD; PHOTOIONIZATION OF NO BY SOLAR LYMAN ALPHA AT 95 km. F.F.Marmo, J.Pressman, L.M.Aschenbrand, A.Jursa and M.Zelikoff.
J. chem. Phys., Vol. 25, No. 1, 187 (July, 1956).

Experiments with a rocket containing 18.5 lb of NO released at 95 km have shown that a high-density electron cloud was formed in accordance with theory. J.M.Hough

551.594.14

9131. GEOGRAPHICAL AND TIME DISTRIBUTION OF RADIOACTIVITY IN THE AIR. I.H.Blifford, Jr, H.Friedman, L.B.Lockhart, Jr and R.A.Baus.
J. atmos. terrest. Phys., Vol. 9, No. 1, 1-17 (July, 1956).

Describes the results of continuous measurements on both natural and fission-product radioactivity of the air at ground-level over a five-year period beginning in 1950. The average atmospheric radon and thoron concentrations are given for fifteen places in different parts of the world. In some cases the diurnal and seasonal variations in these quantities have been determined from continuous measurements. At Washington, D.C., fission-product activity from atomic bombs has been detected in the air for more than 70% of the days from January 1950 to the present time. Similar results have been observed for a number of other locations. Except for short periods, the fission-product beta activity has remained lower than the natural background. The highest concentration was measured at San Diego, California, following the tests of February 1951, where the average fission-product beta activity for a 24-hour period was approximately 6×10^{-16} curie per cubic centimetre of air. A.

551.594:21

9132. CORRELATION OF THE INITIAL ELECTRIC FIELD AND THE RADAR ECHO IN THUNDERSTORMS. S.E.Reynolds and M.Brook.
J. Meteorol., Vol. 13, No. 4, 376-80 (Aug., 1956).

The time of onset of the initial electrification in a thunderstorm cell has been correlated with the appearance of the initial radar (3 cm) precipitation-echo. The results show that precipitation is a necessary, but not sufficient, condition for the onset of thunderstorm electrification. The presence of radar-detectable precipitation does not lead to thunderstorm electrification, unless the precipitation echo evidences rapid vertical development. When this condition is fulfilled, the appearance of the initial electrification is almost coincident with the appearance of the initial radar precipitation-echo. On days when no precipitation echoes were present, no electric fields significantly different from the fair-weather positive fields were observed, although the clouds noted ranged from small fair-weather cumulus to clouds of considerable depth and active convection. A.

551.594.5

9133. RADIO INVESTIGATIONS OF AURORAE AND RELATED PHENOMENA. T.R.Kaiser.
Airglow and the aurorae (Belfast) 156-73. See Abstr. 7088 (1956).

Discusses in some detail the characteristics of auroral ionization as revealed by metre-wavelength radio-echo observations in the auroral and subauroral regions. A close association between the radio-echoes, visual aurorae, magnetic activity, and radio-star scintillations is revealed. A similar correspondence appears to exist between low-frequency auroral-type echoes and scintillations in the minauroral region, although these show some marked differences from the high-latitude phenomena. Some suggestions are made for future lines of work, particularly during the International Geophysical Year, 1957-58. A.

551.594.5

9134. INTENSITY MEASUREMENTS OF THE GREEN AURORAL OXYGEN LINE AND THE NEGATIVE NITROGEN BANDS EMITTED FROM RAPIDLY VARYING AURORAE. A.Omholt.
Airglow and the aurorae (Belfast) 178-82. See Abstr. 7088 (1956).

Photoelectric measurements have been made of the intensities of the forbidden oxygen line 5577 A and the negative nitrogen band 4278 A emitted from aurorae which give rapid intensity variations within a fixed volume of the upper atmosphere (moving or pulsating forms). The lifetime of the oxygen atoms in the metastable ^1S state in the aurorae have been calculated, assuming the excitation rates of the two emissions to be proportional, and the observed time delays between the

wo emissions to be due to this lifetime. The records are consistent with these assumptions, and give lifetimes of the metastable OI ^1S state during these aurorae of the order 0.45 to 0.75 sec. A.

551.594.5

9135. DISCHARGE THEORY OF AURORAL RAYS. J.W Chamberlain.
Airglow and the aurorae (Belfast) 206-21. See Abstr. 7088 (1956).

A provisional theory is developed from the standpoint of the luminosity resulting from inelastic electron collisions. Energy-distribution curves and drift velocities for electrons in an electric field are derived, account being taken of energy losses through inelastic collisions. It is shown that if the electron density, N_e, decreases slowly with height, a ray could be formed in which the green [OI] luminosity is nearly constant over a large range of atmospheric density and altitude. Furthermore, a reasonable assumption for the absolute value of N_e leads to auroral brightness of the correct order of magnitude. The ratio of intensities of the red/green oxygen lines are discussed in terms of collisional deactivation, and an illustrative computation is presented. High-excitation emissions, such as N_2^+, would not be present in the lower part of the ray, but may become strong at higher altitudes. The need for more definitive measurements of height variations in the spectra of pure rays is emphasized. A discussion of ionization equilibrium in a ray indicates that the discharge will maintain the necessary electron density. It is suggested that fluctuations in the brightness of a ray may arise from frequent dispersing of the ray's ionization by upper-atmospheric winds. The production of an electric field in the atmosphere is discussed. It is suggested that incident protons might provide the necessary acceleration of ionospheric electrons, with the electron current becoming constricted along narrow paths, which appear as rays. A.

551.594.5

9136. ELECTRICAL DISCHARGES AND THE INTERPRETATION OF AURORAL TYPES. A.I.Lebedinsky.
Airglow and the aurorae (Belfast) 222-4. See Abstr. 7088 (1956).

A gaseous discharge theory first suggested by Lomonosov (1753) is developed, and applied to the production of auroral arcs and rays. It is found that in arcs, the current flow is 10^3 times greater than in ray-structures. However, in rayed aurorae about the same amount of luminous energy is released as in arc-formations, and so the difference must result from the character of the excitation process: since in the former type the excitation involves low-efficiency ionic collision, whilst in the latter excitation is by electron impact. D.R.Barber

551.594.5

9137. EXCITATION PROCESSES IN THE AURORA AND AIRGLOW. III. LOW-LATITUDE AURORAE. M.J.Seaton.
Airglow and the aurorae (Belfast) 225-43. See Abstr. 7088 (1956).

For Pt II, see Abstr. 6186 (1954). Concerned with the type of world-wide auroral activity observed on rare occasions at geomagnetic latitudes as low as 20-30°. Both ionospheric and auroral observations show that, although there are some low-level effects, the phenomena of principal interest occur at very great heights (≥ 200 km). Ionosphere observations show that n(e|F) drops far below normal. The residual ionization is very high, very patchy and spread out and shows rapid movements. The main low-latitude spectral characteristics are: great strength of the N_2^+ negative group; great enhancement of the [OI] red lines; some enhancement of the [OI] green line; presence of [OI] λ5199. It is shown that the N_2^+ emission is due to resonance in the sunlit atmosphere. The mean N_2^+ density is estimated to be $\bar{n}(N_2^+) \simeq 300$ cm^{-3}. Even at heights ≥ 740 km, $\bar{n}(N_2^+)$ is sometimes ≥ 120 cm^{-3}. The electron density is estimated to be 10^3-10^4 cm^{-3}. It is considered that the forbidden lines are excited by fast electrons produced in high atmosphere current systems. The parameter E (= field strength times mean free path) being estimated to be of order 1 eV from the [OI] red/green intensity ratio, the absolute [OI] red-line intensity is calculated and found to be in good agreement with observation. Current densities indicated are 10^{10}-10^{11} electrons cm^{-2}.sec^{-1}, giving an integrated current of order 0.06 amp.cm^{-1}. From the ratio of [NI] to [OI] intensities it is estimated that n(N)/n(O) ≃ 0.15 in the emission region. All numerical results refer to the aurora of 18-19 September, 1941. A.

551.594.5

9138. EXCITATION PROCESSES IN THE AURORA AND AIRGLOW. IV. ON THE EXCITATION OF PERMITTED OI LINES IN HIGH-LATITUDE AURORAE. I.C.Percival and M.J.Seaton.
Airglow and the aurorae (Belfast) 244-48. See Abstr. 7088 (1956).

Excitation mechanisms are discussed for the OI lines $3p\,^5P \rightarrow 3s\,^5S$, λ7774 and $3p\,^3P \rightarrow 3s\,^3S$, λ8446. Auroral observations give I(7774)/I(8446) between 0.3 and 3.0 and I(7774)/I(5577) ≃ 0.3. The hypothesis is examined that $3p\,^5P$ is excited by collisions between electrons and ground-state oxygen atoms. Using calculated excitation cross-sections it is shown that this hypothesis would lead us to expect I(7774)/I(8446) to be < 0.3 and I(7774)/I(5577) to be ≪ 0.1. It is concluded that the hypothesis of electron excitation is improbable. It is considered probable that the permitted OI emissions result from collisions producing dissociation of oxygen molecules into excited atoms. A.

551.594.5

9139. NOTE ON THE RELATIVE INTENSITIES OF THE OI MULTIPLETS $3s^5S^0 - 3p^5P$ AND $3s^3S^0 - 3p^3P$ IN AURORAE. P.Swings.
Airglow and the aurorae (Belfast) 249-50. See Abstr. 7088 (1956).

Although lab. intensities, and excitation potentials of the OI infrared multiplets at 7772 A, and 8446 A are similar, the auroral intensity of the doublet is always the stronger of the two by a factor often as great as 3 : 1 (Petrie and Small, 1953). This result may be explained by monochromatic fluorescence, producing an enhancement of the $3s^3S^0 - 3p^3P$ transition relative to $3s^5S^0 - 3p^5P$ when OI atoms are exposed to auroral Lyman-β radiation. D.R.Barber

551.594.5

9140. NOTE ON THE PROCESSES GOVERNING EMISSION BY INCIDENT HEAVY PARTICLES. D.R.Bates.
Airglow and the aurorae (Belfast) 251-3. See Abstr. 7088 (1956).

551.594.5 : 550.385 : 523.72

9141. SOLAR NEUTRON EJECTION AS THE CAUSE OF AURORAE AND MAGNETIC STORMS. V.A.Petukhov.
Airglow and the aurorae (Belfast) 254-61. See Abstr. 7088 (1956).

It is suggested that the incoming streams causing aurorae and magnetic storms consist initially of neutrons ejected from the sun, the neutrons decaying into protons and electrons during their passage to the earth. The consequences of the suggestion are discussed in detail. A.

551.594.5 : 535.333

9142. LABORATORY STUDIES OF AURORAL EXCITATION. C.Y.Fan.
Airglow and the aurorae (Belfast) 276-82. See Abstr. 7088 (1956).

When low-energy protons (5-350 keV), and He^+ ions (10-450 keV), were allowed to interact with air at low pressures (0.5-100 microns Hg), Doppler-shifted H and He lines could always be detected. The charge exchange process is of so

great importance that the relative intensities of the negative, and Meinel N_2^+ systems in an ionic impact spectrum are found to differ significantly from those excited by electrons.

D.R.Barber

551.594.5 : 535.332

9143. THE LABORATORY EXCITATION OF AURORAL INFRA-RED OI LINES. P.W.F.Gribbon and D.T.Stewart.
Airglow and the aurorae (Belfast) 287-8. See Abstr. 7088 (1956).

The lines λλ7774 and 8446 have been produced, using controlled electron beams at low pressures. The observed intensity ratio is in agreement with the auroral ratio. It is suggested that these lines originate by simultaneous excitation and dissociation of O_2 molecules following single-electron impact. A.

551.594.5 : 535.33

9144. TRANSITION PROBABILITIES OF AURORAL LINES. R.H.Garstang.
Airglow and the aurorae (Belfast) 324-7. See Abstr. 7088 (1956).

T.P. values are tabulated for the $2p^3$ configuration of the forbidden lines of OII and NI, and also for the auroral line, 5577 A. It is pointed out that the most probable value for the latter is about 25% smaller than that based on an s_q value derived from a self-consistent field with exchange, viz. 1.0 $sec^{-1} \pm 0.2$. For the ions, OII and NI, transition probabilities for the $^2P - {}^4S$, $^2P - {}^2D$, and $^2D - {}^4S$ lines may be in error by ±20%, ±40%, and ±50% respectively. D.R.Barber

551.594.5 : 535.33.07

9145. A SLITLESS SPECTROGRAPH DESIGNED TO PHOTOGRAPH THE SPECTRA OF AURORAE. A.I.Lebedinsky.
Airglow and the aurorae (Belfast) 388-94. See Abstr. 7088 (1956).

A convex mirror is mounted horizontally, with a diametral slotted diaphragm placed vertically above it. The portion of the sky-field, seen by reflection through the narrow aperture, is photographed by a prismatic camera, the refracting edge of the prism being parallel to the axis of the slit. In this way, a great gain of light-grasp (> 12 times that of a conventional auroral spectrograph) is achieved: but the linear scale of the monochromatic images is extremely small, the length of an auroral arc of 180 degrees being only 3-4 mm.

D.R.Barber

551.594.5

9146. PRELIMINARY STUDIES OF THE DISTRIBUTION OF AURORAS IN ALASKA. C.T.Elvey, H.Leinbach, J.Hessler and J.Noxon.
Trans Amer. Geophys. Un., Vol. 36, No. 3, 390-4 (June, 1955).

The analysis of auroral observations for 1951-53 from five stations spread over Alaska shows a zone at geomagnetic latitude 68° for which the incidence of auroras is independent of magnetic activity. At geomagnetic latitudes south of 67°, the incidence of auroras is markedly dependent upon magnetic activity. A

551.594.5 : 535.333

ELECTRON FUNCTIONS OF N_2^+ BANDS. See Abstr. 8654

551.594.5 : 535.332

EXCITATION OF FORBIDDEN ATOMIC LINES BY ELECTRON IMPACT. See Abstr. 8651

551.594.6

9147. ON THE PROPAGATION OF WHISTLING ATMOSPHERICS. G.R.Ellis.
J. atmos. terrest. Phys., Vol. 8, No. 6, 338-44 (June, 1956).

It is shown that the dispersion of whistling atmospherics propagated along the lines of force of the earth's magnetic field should be greatly dependent on the geomagnetic latitude of the observing point. The change in the magnetic-field intensity along a line of force produces an upper-frequency limit for whistler propagation which, at latitudes greater than 62°, should fall within the usually observed frequency region of 1-10 kc/s. Dispersion curves showing this critical frequency are given for geomagnetic latitudes 55°, 60° and 65°. A.

551.594.6 : 551.510.535 : 523.72

9148. SUDDEN DECREASE IN LOW-FREQUENCY ATMOSPHERIC NOISE DURING THE COSMIC-RADIATION STORM OF FEBRUARY 23. C.A.McKerrow.
Nature (London), Vol. 177, 1223-4 (June 30, 1956).

The r.m.s. noise amplitude measured at Manitoba (lat.58.8°N., long.94.2°W.) has been plotted and shows a sudden decrease of atmospherics beginning at 0345 G.M.T. on that day. The largest part of this decrease is a drop by 6 dB in less than 10 min; the noise level did not return to its normal value until February 27. The vertical-incidence sweep-frequency ionospheric recorder (range: 0.6 - 20 Mc/s) showed signs of increased absorption at 0445 G.M.T. increasing to a total blackout by 0530 hr. During the next 65 hr. a total of 53 hr. of blackout was recorded. At Baker Lake (64.3°N., 96.0°W.), the recorder showed blackout first only at 0600 hr., and, during the next 65 hr., 47 hr. of blackout. At Winnipeg and Ottawa no immediate effects of the ionospheric storm were apparent, except for a high degree of absorption at the minimum frequency of fOE and an unusual amount of sporadic E during daylight period. E.W.Kellermann

BIOLOGY 57/59

578.08 : 535.434

A PRIORI CALCULATION OF THE NUMBER OF BACTERIA IN A TURBID SUSPENSION. See Abstr. 8715

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612.1 : 539.165

9149. BETA-RAY ACTIVITY OF HUMAN BLOOD. A.I.Danilenko.
Dokl. Akad. Nauk SSSR, Vol. 107, No. 5, 683-4 (1956). In Russian.

612.842.3

9150. RELATION OF CHANGES IN PUPIL SIZE TO VISUAL DISCOMFORT. J.M.Fugate and G.A.Fry.
Illum. Engng, Vol. 51, No. 7, 537-49 (July, 1956).

A subject's left eye was adapted to a 51° diameter field of a given luminance, approx. 1, 10 or 100 ft L. The central portion of the field was then increased in luminance for one second and the maximum pupillary contraction shown by the right eye was measured for various sizes and luminances of the central area. It was found that the luminance and size corresponding to the borderline between comfort and discomfort produced a contraction of about 1.5 mm in diameter. A number of other investigations were made, one of the level at which involuntary blinking took place, another of the effect of a mydriatic by which contraction was prevented. J.W.T.Walsh

612.843

9151. SOME FACTORS AFFECTING SCOTOPIC VISION. J.Baleriola and J.Oliva.
An. Real Soc. Espafi. Fís. Quím., Vol. 52 (A), No. 3-4, 65-74 (March-April, 1956). In Spanish.

The differential threshold was measured as a function of the size of the surround for three parameters: luminance level, size and retinal location of test-field. Except for a test size of 30' at an eccentricity of 6^0 and a level of 10^{-4} nits - when there was no variation - the threshold decreases for surround sizes of up to 15^0. Beyond an eccentricity of 20^0 the threshold was constant, nor did a change of luminance by one log unit have much effect. Studies of visual acuity were also made. The effects of field size, field direction and luminance level on pupillary diameter were studied with flash photography. R.A.Weale

612.843.31

9152. FOUR-DIMENSIONAL NATURE OF COLOUR SPACE IN HUMANS. M.M.Bongard and M.S.Smirnov.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 3, 447-9 (1956). In Russian.

Since twilight vision, in frogs and humans, is based on the presence of rhodopsin, and the twilight receiver of the frog operates not only near the threshold, but also at brightness values > 100 apostilbs, an investigation was carried out to determine whether the same applies to humans. The operation of the twilight receiver was studied in the presence of three daylight receivers, using colorimetric method; the compared fields were presented successively to the observer. It was found that, even for very high brightness values (up to 1000 apostilbs), the twilight receiver operates simultaneously with the daylight receivers. F.Lachman

612.843.32 : 612.843.613

9153. ADAPTATION OF THE LIGHT- AND COLOUR-PERCEPTION APPARATUS OF THE EYE. A.A.Gyurdzhian.
Dokl. Akad. Nauk SSSR, Vol. 107, No. 3, 405-8 (1956). In Russian.

Presents the results of measurements of the light and colour (spectral) sensitivity of the retina periphery, carried out immediately after the eye has become adapted to different spectral stimuli of equal brightness. The apparatus consists of two analogous parts: (1) the so-called "fatigue" device, for bringing about the light adaptation to spectrum and white stimuli, and (2) the monochromatic adaptometer or sensitometer for determining the thresholds of sensitivity. Each part consists of a monochromatic source, a set of light filters and wedges, and other accessories. In tests, a 60^0 portion of the retina was subjected to adaptation, the sensitivity being determined for a 5^0 sector, ca. 15^0 from the retina centre along the temple semi-meridian. Eight spectrum sectors (between 4360 and 6900 A) and white light were used for the adaptation and determination of sensitivity. The equalization of brightness was attained by heterochromatic photometry on a flicker photometer. After a 3-5 minute adaptation the sensitivity thresholds (light and colour) to the first stimulus (4360 A) were determined; the adaptation was then continued for 1-2 minutes, after which the sensitivitiy was determined for the next wavelength, and so on. Results obtained in 100 tests with 2 persons were plotted on suitable coordinates. It was found that: (1) different parts of the spectrum have a different value as adaptation stimuli, the adaptation effect varying continuously with the wavelength, and (2) the effect of different adaptation stimuli on the light sensitivity gives a picture completely different from that of the same stimuli on the colour sensitivity. Two graphs provide some quantitative data on the relationship between the light (total) and colour sensitivity on one hand, and the wavelength of the stimuli used on the other. F.Lachman

612.843.32 : 612.843.613

9154. VARIATION OF DARK ADAPTATION AFTER THE EYE HAS BEEN "FATIGUED" BY STIMULI OF DIFFERENT WAVELENGTH. A.A.Gyurdzhian.
Dokl. Akad. Nauk SSSR, Vol. 107, No. 4, 537-40 (1956). In Russian.

The apparatus and method used are the same as those described earlier (see preceding abstract). The results obtained from 340 tests on 4 persons show that: (1) the fatigue caused by long-wave stimuli lowers the light (or total) sensitivity less than that caused by any other stimulus of equal brightness, whereas (2) the fatigue caused by short-wave stimuli lowers considerably the light sensitivity which is only slowly restored in the course of the following dark adaptation, and (3) the stimuli of intermediate wavelength show intermediate effects. As far as the colour sensitivity is concerned, it is the fatigue by long-wave stimuli that has the greatest effect, while short-wave stimuli affect it to the least extent. At the beginning of dark adaptation, both the light and the colour sensitivity increase, reaching large values. Then the colour sensitivity begins to fall, and an increasing photochromatic interval appears. This lasts for up to 30 minutes. Sometimes the initial colour sensitivity exceeds that at the end of the test. At the same time the light (or total) sensitivity increases. The correlation between the two sensitivities is called "allied" in the first, and "reciprocal" in the second stage. F.Lachman

612.843.613

9155. FREQUENCY-OF-SEEING CURVES AND SPONTANEOUS EXCITATION. F.H.C.Marriott.
J. Opt. Soc. Amer., Vol. 46, No. 8, 661 (Aug., 1956).

The effect of "noise" on the number of quanta required for the threshold of vision is discussed. R.A.Weale

612.843.63

9156. PERCEPTION OF THE DETAIL OF MOVING OBJECTS. G.van den Brink.
Electrotechniek, Vol. 34, No. 15, 309-10 (July 26, 1956). In Dutch.

Details of experiments based on the use of a test object consisting of two short lines of light at a certain distance apart, presented to the observer as a flash of a known duration on a circular orbit, the eyes being fixed straight ahead. Beyond a certain critical value of the displacement (velocity x time) the separation of the lines is no longer perceptible. Charts show the distribution of light energy as a function of the velocity and displacement for directions normal and non-perpendicular to the test object and for different spacings of the lines. G.du Cloux

612.85 : 534.78

RELATIONS BETWEEN AUDITION AND PHONATION.
See Abstr. 8636

612.858

9157. ON THE TYPE OF OSCILLATION OF THE BASILAR MEMBRANE PRODUCED BY IMPULSES AND NOISES, MEASURED BY AN ELECTRICAL MODEL OF THE INNER EAR. H.Bauch.
Frequenz, Vol. 10, No. 7, 222-34 (July, 1956). In German.

An electrical model of the inner ear is described. It consists of a chain of 65 elements, each consisting of a type of LCR network. The model is excited by Gaussian impulses and the measurement of the response gives information, by analogy, about the basilar membrane and the cochlea. For previous literature see Bekesy, Akustische Zeitschrift, Vol. 7, 173 (1942), and Abstr. 4366/1949, 2742/1947, 5952/1951. L.S.Goddard

614.898

9158. PROTECTION AGAINST RADIATION FROM NUCLEAR REACTORS. G.Deloux.
Bull. Soc. Franc. Elect., Vol. 6, 442-54 (July, 1956). In French.

A review of the problems which arise in the construction of a nuclear reactor, in particular the question of protection of personnel against the radiation and radioactive gases which are produced. The properties of the radiations and materials for the protective barrier are detailed, the levels of radiation intensity and of the contamination of air and water which can be tolerated while remaining within the limits of safety are discussed. A number of existing and proposed nuclear reactors are described. T.A.Chalmers

614.898

9159. X-RAY HAZARD IN SPUTTERING APPARATUS. J.F.Strachan and N.L.Harris.
Nature (London), Vol. 178, 588-9 (Sept. 15, 1956).

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77.023 : 771.53

9160. A CONTRIBUTION TO THE EXPLANATION OF THE SABATTIER EFFECT. F.Klötzer.
Z. wiss. Photogr., Vol. 50(II), No. 1-12, 386-92 (1955). In German.

Unexposed plates were brought into contact with variedly exposed plates during the developing of the latter. After washing, exposure to diffuse light and normal developing of the former blackening giving a positive — the Sabattier effect — is found. Conclusions are drawn about the solution processes taking place in the proximity of the emulsion grains during developing and their dependence on the concentrations (in turn dependent on length of exposure and on diffusion) of silver halide and oxidation products of the developer. It is suggested that these processes might play a part in normal developing. W.Good

771.534

9161. THE INFLUENCE OF PRESSURE ON THE SENSITIVITY OF A PHOTOGRAPHIC EMULSION. L.Waniek.
Czech. J. Phys., Vol. 6, No. 3, 246-55 (June, 1956). In Russian, with summary (400 words) in German.

The application of steady and impulsive pressures of about 3000 Kg/cm^2 to a photographic film before exposure reduced its sensitivity by about 10%. If the film had already been exposed, then pressure increased the sensitivity by about 10%. Moving a loaded point on the film produced blackening irrespective of exposure but anti-friction arrangements prevented this. It is suggested that a distinction should be made between normal and tangential pressures rather than between static and dynamic loading when discussing the effects of pressure. A.L.Mackay

771.535

9162. A QUANTITATIVE THEORY OF THE PHOTOGRAPHIC ACTION. E.A.Baker.
J. photogr. Sci., Vol. 4, No. 4, 101-6 (July-Aug., 1956).

A theory of the photographic process (external image) is put forward in which uniform grains are regarded as similar and without discrete sensitivity centres before exposure, differences after exposure being attributed to random photon distribution. The theory accounts for a wide range of qualitative and quantitative results. A.

778.33

9163. AUTORADIOGRAPHY IN THE STUDY OF SURFACE PHENOMENA. B.Verkerk.
Nucleonics, Vol. 14, No. 7, 60-4 (July, 1956).

A description of the techniques using Kodak autoradiographic plates. Metal samples were prepared using ion-exchange, preferably with a K-capture isotope. Some results of investigations of the absorption of chlorine by aluminium oxide films are included. R.D.Smith

778.34

9164. PHOTOGRAPHIC EMULSIONS FOR NUCLEAR RESEARCH. C.Waller.
Z. wiss. Photogr., Vol. 50(II), No. 1-12, 434-52 (1955). In German.

A survey of the role photographic emulsions have played in nuclear physics and cosmic ray research. The development of the technique from the early days of half-tone emulsions to the present day when stacks of stripped emulsions of many litres are used is carefully traced. 35 refs. D.J.A.Prowse

778.34 : 535.822.9

MICROSCOPE FOR LARGE NUCLEAR PLATES. See Abstr. 8141

778.37 : 621.3

9165. HIGH SPEED PHOTOGRAPHY. APPLICATIONS IN ELECTRICAL RESEARCH. H.H.W.Losty.
Engineering (London), Vol. 182, 130-2 (Aug. 3, 1956).

The conventional cine-camera is limited to about 250 frames/sec. High-speed cameras using a rotating prism and continuously-running film raise the limit to 1000 frames/sec for 35 mm, 4000 for 16 mm, and 8000 for 8 mm film. Even greater speeds are achieved by removing the prism and exchanging the gate for a narrow slit. In this so-called streak camera, the position of the image moves and, with known film speed, the time/position relationship can be determined. Examples illustrated are: ignition of a multiple-charge photoflash bulb; appearance of an argon welding arc (with twin W-electrodes) for Al-sheathed cables; operation of an electromechanical counter; vibration of a whisker of Si diode (with streak camera). C.F.Pizzey